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MINERAL NUTRIENT RELATIONSHIPS OF FOREST TREES

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IN a recent publication of Goodall and Gregory (1947) an excellent and comprehensive account of the development, practice and potentialities of plant analysis is presented with particular reference to the use of this technique for the diagnosis of disturbances in mineral nutrition. Although a number of references are made to investigations dealing with forest trees, by far the greater part of the publication is devoted to agricultural and horticultural crops. To those interested in forestry, there naturally arises the question how much work of this kind has been done on forest trees and whether the data obtained can be applied in a similar way. It is the intention of this article to review briefly the advances which have been made in the study of the mineral nutrition of trees and to discuss the applications of the results to forestry practice. It is unfortunate that in view of the wide field of research to be discussed, this article must necessarily be strictly limited to forest trees; for a general discussion and the relevant literature on other plants, the reader is referred to the above work of Goodall and Gregory.

Even by the beginning of the present century, a great deal of information had been accumulated on the mineral nutrient relations of trees. The early investigations of Schütze (1869–1876), Ebermayer (1876), Schröder (1878), Wolff (1880), Councler (1886), Ramann (1892), Schmitz-Dumont (1896) and others, had laid down a firm foundation of knowledge concerning the general nutrient requirements, distribution and variations in the tissues and litter of most of our common hardwoods and softwoods (cf. Büsgen and Münch, 1929, p. 325). Since then, innumerable investigations have been made into many phases of tree nutrition; so many, in fact, that to-day, rather than there being a paucity of information, we are confronted with an almost overwhelming amount of data.

The application of tissue analyses to problems of nutritional disturbances in trees has, of course, received a great deal of attention. As early as 1873; Flîche and Grandeau compared data on the needles of *Pinus pinaster* and showed that poor growth was associated with a higher Ca and lower K content. Since such observations must necessarily be based on comparisons with normal specimens, it is unfortunate that the situation is complicated not only by variations in the mineral composition of samples with site but also by variations with position on the tree, with season, and with age.

Variations in Mineral Composition of Foliage.

(*a*) *According to Location on the Tree.*

The tree foliage is generally associated with the greatest relative accumulation of nutrients, but variations may occur according to the type of leaf and its relative position on the tree.

Seiden (1926) found that the ash content of hardwood leaves increased from the base to the top of the tree. Němec (1940*a*), in an analysis of a Ca-deficient Spruce, found the lowest Ca concentration in the young needles at the tree apex, the concentration increasing towards the base of the crown. A more comprehensive investigation (1940*b*) involved the comparison of the composition of needles, at 1-m. intervals along the stem, of healthy and dying Silver Fir specimens. In the sound tree the per cent. N increased towards the top whereas a corresponding decrease was observed in the dying tree. Whilst the sound tree showed an increasing per cent. K towards the apex, the dying tree did not show a maximum per cent. K in this region. The Si content of the sound tree was low, especially in the upper regions of the crown, whereas the corresponding Si content of the dying tree was particularly high at this point. Both sound and dying trees revealed somewhat similar trends in the other elements investigated. Thus the ash and P contents increased, whereas the Ca, Mn and Fe contents

decreased, in the direction of the apex. The K content also varied with height but Mg was found to be practically constant. Wallihan (1944) reports significant differences in the N and K per cent. of basal and tip leaves of the Sugar Maple on a given twig. The Ca content appeared to be most variable but could not be correlated with leaf position and there was little evidence of difference in the composition of sun and shade leaves. Němec (1947) found similar variations in the Ca and K contents of the foliage of Yew according to the position in the crown. The Ca content increased towards the base of the tree whereas the K content showed maximum values at the base and apex with a minimum between. Hale (1947) observed large differences in the concentration of each element between the inner, middle and outer frond whorls of the Oil Palm. Bertrand and Rosenblatt (1922) found a variation in the Mn content of various species according to the location of the leaves, and Gutschick (1940) reported a higher Mn content in the shade needles of Spruce and Pine as compared with the sun needles of the same trees. Krauss (1926) also considers that sun and shade needles vary in Si content.

As a result of his investigations, Wallihan (1944) recommends a random sampling of 50–100 leaves from the most accessible part of the crown as being as representative as any sample obtained by a planned selection procedure. Mitchell (1935) on the other hand, attempted to overcome this variation by analysing needles from the same relative position on the tree.

(*b*) *According to Season.*

Investigations into the seasonal absorption and movement of mineral nutrients emphasize the importance of the time factor in comparative nutritional studies on trees. Different species vary not only in their requirements for nutrients but also in the times at which these nutrients are absorbed, these variations being reflected in a varying mineral content of the foliage. As early as 1896 various German research establishments found it necessary to agree on a particular time of year for sampling, viz. autumn collections of 2-year-old needles of Spruce and Fir and 1-year-old needles of Pine.

Much of the work in this field has been connected with the mineral-nutrient cycle in litter studies and has revealed a general tendency for the percentages of Ca and Si in the foliage to increase during the season, with a corresponding fall in the percentages of N, P and K.

Henry (1908) showed that the per cent. of Ca in the ash of Oak, Beech, Spruce and Larch, increased from May to October, whereas the content of N, P and K decreased. Many other investigators have produced somewhat similar results. McHargue and Roy (1932) found that in various deciduous trees, the ash, Si and Ca contents increased during the season whilst the N, P and K contents decreased. Alway *et al.* (1934) also observed a seasonal increase in Mg and a decrease in S. Deleano and Bordeianu (1933) reported a back movement of Si, P, K, Mg and N from the foliage after the period of leaf development in Chestnut and similarly in *Salix*. Piney (1929) found that in Beech the per cent. N fluctuates slightly during the winter but reaches a maximum just before flushing, whilst Chapman (1935) found a steady fall of per cent. N in the Elm leaf from July to November, and in the Black Locust an increase from July to September followed by a fall. Sampson and Samisch (1935), in a series of investigations with various species of Oak, reported an increase in the Ca and Si content of the leaves with increasing age, whilst Chapman (1941) found that older Rubber (*Hevea*) leaves contained less N and P.

Mitchell (1936) emphasizes, however, that changes in concentration in the leaves do not necessarily mean translocation of minerals, since the leaves are increasing in dry weight. For a number of species he showed that on a basis of absolute mineral content, not only Ca but also N, P and K tended to increase. During the period of rapid growth, the rate of dry weight increase is greater, therefore, than that of the intake of those nutrients which show a fall in per cent. dry weight. The absolute amounts of N, P, K and Ca increase to a maximum just before the leaves turn colour, after which there is a back translocation of N, P and K but no loss in Ca. He suggests that the best time for collecting leaf samples for quantitative comparisons is during the 2–3 weeks before yellowing, when the total mineral content is at a maximum and the concentration relatively constant.

Rissmüller (1874) had already shown that in Beech leaves the absolute content of K and P did not decrease with age although the per cent. values showed a distinct fall. Chandler (1939) also found that both the absolute and per cent. dry weight of Ca in the foliage of a number of species increased throughout the season; the longer the foliage remained on the tree, the greater was the Ca content. Different species showed characteristic differences in the rates of increase in Ca content. Sampson and Samisch (1935) report a rapid rise in the K content of Oak leaves in the spring, with a declining increase during the summer, resulting in a fall in the K/dry weight per cent., whilst in the autumn there was a pronounced back translocation. The P content of these leaves showed an early peak. Echevin (1931), working with Beech, observed that in the spring, 50 per cent. of the P present in the stems and roots, moves to the leaves, the reverse movement taking place at the end of May. Sulphur showed a similar behaviour but there was no decrease in the autumn. Later (1932), Echevin demonstrated for many other hardwoods a slow decrease in P content at the end of the summer followed by a rapid fall as the leaves yellowed.

Minor elements such as Mn and B also show marked changes in concentration throughout the season.

Bertrand and Rosenblatt (1922) found that the accumulation of Mn in the leaves of various species varied according to environmental conditions but was generally greater during the period of leaf development. Some species exhibited a second maximum later in the season whereas others showed a progressive decrease. Bertrand and Silberstein (1940) report a somewhat similar behaviour on the part of B in the leaves. Quarteroli (1929) observed a progressive increase in Mn but a decreasing Cu content.

(*c*) *According to the Time of Day.*

Ramann (1912) found that the Ca content of Beech, Oak and other leaves varied from day to night but this did not occur with N, P or K. Chapman (1941) also states that leaf composition may vary according to the time of sampling.

(*d*) *According to the Age of the Foliage.*

When more than one year's foliage is retained on the tree, differences in composition may also occur according to the age of the foliage. It would appear that, in general, older needles form better material for analysis in so far as they tend to be depleted at the expense of the growing regions.

For *Pinus radiata*, Askew (1937) reported that on the same tree, the older needles contained more Ca, Cl and Mn and less N and P whereas the Mg, K and Fe contents remained fairly constant. For other conifers the Mg content appeared to increase with age. McCool and Johnson (1938) found that the S content of needles increases year after year where SO_2 is present in the atmosphere.

(*e*) *According to the Age of the Tree.*

Variations in mineral content may also be found in similarly aged leaves sampled from trees of different age on the same site.

In hardwoods, Manshard (1933) observed that the Ca content increased with tree age whereas the Mg, P and K contents remained practically unaltered. In softwoods there was a marked decrease in Mg, P and K with increasing age of the tree. Askew (1937), analysing young needles of *P. radiata*, found that as the trees aged the Ca, P, Na, Cl, and Fe contents decreased whist the Mg, N, K and Mn contents increased. Gutschick (1940) reported that the leaves of sheltered young Beech and the needles of sheltered Spruce flushes were richer in Mn than the leaves and needles of older trees in the same stand.

Seasonal Differences in Mineral Uptake.

Bauer (1910) investigated the absorption of nutrients by Spruce, Larch, Pine and Fir seedlings in relation to the production of dry weight. Analyses were made during four characteristic growth periods and showed that each species was associated with a characteristic behaviour according to the stage of development. Later (1911), he repeated the work with hardwoods and demonstrated a greater demand for nutrients by species like Ash, which he associated with a greater production of dry weight during the experimental period. Compared with softwoods, the absolute mineral content was much greater but the differences in per cent. content were much less marked. In 1912 Bauer extended these investigations to cover *Quercus pedunculata* and Kübler (1912) carred out a similar experiment on Beech, the results of which were in accordance with previous work on other species. Ramann (1911), and Ramann and Bauer (1912), made an extensive investigation into the periodic mineral uptake by Spruce, Larch, Pine, Fir, Beech and *Q. pedunculata*. Each species was found to have characteristic periods of absorption of particular mineral elements, e.g. Spruce absorbed most of its P during the period May–July, Pine during July–September, Larch during September–November and Fir during February–July. Ramann stresses the relationship between such seasonal differences in behaviour, the time of appearance of deficiency symptoms (see Möller, 1904) and the time for fertilizer application (see Bauer, 1910). This phenomenon may also have some bearing on the success of mixed planting of species as compared with pure stands.

The Site Factor as affecting Mineral Composition.

The limitations of chemical analyses of soils as a means of assessing their potentialities for tree growth are well known, for it is impossible to simulate the absorptive activities of the tree roots

sufficiently accurately. The advantage of analyses of tree foliage and other tissues lies in the fact that we are effectively estimating the ultimate nutrient absorption irrespective of the complicated phenomena associated with the tree/soil relationship. This is the basis of the Nebauer method for determining soil fertility. Süchting *et al.* (1938) and Süchting (1939*a*, 1940, 1941, 1942) have used this technique extensively in determining the availability of nutrients in various soil types by growth and subsequent analysis of tree seedlings. Their results have been compared with those obtained by chemical analysis of the soils and with some exceptions, notable in the case of P, good agreement was generally obtained between the two methods. The results obtained by other investigators, however, do not in general reveal a consistent agreement between soil and tissue analyses.

Bard (1945), in an attempt to correlate the soil mineral status with the Ca, P, K and N contents of hardwood foliage, suggests that the Ca content of the leaves was dependent more on the inherent capacity of the species to absorb Ca than on the Ca level in the soil. According to his analyses the K content of the leaves could be correlated with the K content of the soil, but no similar relationship was found in the case of N. . In many cases the influence of tree age may be greater than the influence of the site in determining the ash and P content of the trees. Burger (1931) made a comprehensive survey of the physical and chemical properties of a number of soil types and the corresponding mineral content of both hardwoods and softwoods growing on these sites. Generally no clear-cut correlation between his determinations of soil status and tree composition was observed. Whilst the Ca and Mg content of the foliage increased with increasing replaceable Ca and Mg in the soil, no consistent relationships were found for P, K, Fe or Si. It is interesting to note, however, that the so-called lime factor, i.e. the CaO/MgO ratio, remained relatively constant in the trees despite large variations in the soils. Kessel and Stoate (1936), in an investigation into the nutrition of poorly growing Pines, found that sites bearing good Pine had significantly higher P and N contents than poor Pine sites. They could, however, find no significant differences in the composition of the needles from good and poor trees except in the Na values. Later (1938), they suggested that a determination of the P content of the soil could be used as a valuable guide for assessing the potentialities of certain sites. Young (1940) observed that the P content of Pine needles could be related to the P content of the soil when the soil was deficient in P, but when the P level was sufficient for healthy growth, the P content of the foliage tended to remain constant.

This aspect of tree nutrition has also received a great deal of attention particularly with regard to site/species/litter investigations. Although such investigations are naturally of great importance in any study of the mineral nutrient cycle in forests, they are in themselves somewhat beyond the scope of this review except so far as the experiments include valuable data on tissue composition, particularly in connexion with the Ca status. It would appear from the results obtained that, as a rule, soil type is only one of the factors which determine the mineral composition of the tree. Whilst considerable variation may be found in the composition of even the same species from different sites, to a certain extent certain species are characterized by e.g. a higher Ca content independent of site.

A good bibliography on this subject may be found in Lutz and Chandler (1946); see also Ramann (1912), Auten (1930), Garstka (1932), Lyford (1941), Dzens-Litovskaya (1946).

Seedling analyses have proved of great value in following the response of many species to fertilizer applications. Němec (1937–1941) has made extensive investigations in this field, especially with regard to the nutrition of Norway Spruce in nursery trials. The influence of various N, P and K fertilizers* not only on the uptake of N, P and K but also on the uptake of other nutrients (Ca, Mg, Mn, Si, Fe and Al) has been thoroughly investigated, and the results reveal the complexity of the interrelationships involved. With N fertilizers, for example, the Mg uptake may be increased on soils low in P and decreased on soils high in P. The absorption of N itself would appear to depend not only on the N content of the soil but also on the Ca or P level and the pH.

Similar investigations have also been carried out on both forest and nursery soils by Süchting *et al.* (1937) and Süchting (1938, 1943*a* and *b*). Dyke (1939), in an article on the fertilizing of Rubber trees, emphasizes the limitations of fertilizer experiments unless the phenomenon of antagonism is fully appreciated. Chapman (1941) developed a method of leaf analysis as a guide to the fertilizing problems of Rubber and Oil Palm. He found that the absolute and not the percent. content of nutrients in Rubber leaves was important within the range studied.

The experiments of Mitchell (1934) represent a somewhat different approach to the relationship between tree mineral status and environmental conditions. He emphasizes the limitations of chemical tests as a means of assessing soil fertility and proposes the use of standard sand cultures

* See Němec references 1937*a*, 1938*a*; 1937*b*, 1938*b*, 1939*b*; and 1939*a*, 1940*c*, respectively.

as a means of establishing a reference scale allowing for exact quantitative comparisons of the available nutrients in forest soils. Where other factors were not limiting, he showed that the quantity of a nutrient within the plant was proportional to the quantity of that nutrient available to the roots. Thus for Scots and White Pines, both the per cent. and absolute N content of seedlings (or their needles) grown in sand cultures with a varying N content, was, up to a certain value, proportional to the N supply. This relationship was found to be relatively independent of other environmental factors although the relative concentrations may be higher under adverse conditions. Therefore, by comparison of the N content of seedlings grown in natural soils and in standard sand cultures, the relative availability of N in these soils could be determined. Whilst fertilizing of forest soils is generally not a practicable procedure, this technique of foliage analysis could be applied to the evaluation of quantitative nutrient variations due to natural agencies or silvicultural treatments.

An earlier investigation by Aldrich-Blake (1930) had already shown that the N content of Corsican Pine seedlings was proportional to the N supply. Gast (1937) made a comprehensive investigation into the N nutrition of Scots and White Pine seedlings under different illumination intensities and corroborated this relationship. He also used these data in determining the availability of N in various soils.

Later (1939), Mitchell extended his work on White Pine to cover the elements P, K and Ca. In a series of sand cultures each element was varied individually whilst all the other elements were supplied in constant and approximately optimum amounts. A high degree of correlation was found between the concentration of these elements in the needles (per cent. dry weight) and the external concentration.

Similar investigations employing different levels of fertilizer application have been carried out on natural stands in the field and the results would appear to emphasize the applicability of this technique to the determination of available nutrients in forest soils.

Mitchell (1935) analysed the P content of Oak, Ash and Maple treated with different levels of P fertilizers and found a linear relationship between the per cent. P in the leaves and the amount of P supplied. Mitchell and Chandler (1939) carried out similar manurial experiments with N at different levels of application and found a high degree of correlation between the soil N supply and the N content of the leaves. It would also appear that the K content of the leaves was proportional to the supply in the soil. Finn (1942) has used such analytical data on Red Oak leaves to follow changes in the availability of soil nutrients after fertilizing. Chapman (1935) found the per cent. of N in Elm leaves to be greater in a stand mixed with Black Locust than in a pure stand, which suggests a greater amount of available N. Adams (1928) grew Jack Pine at different spacings and found, along with changes in dry weight production, significant changes in the nutrient status of the needles, the concentrations increasing with decreasing density of stocking. By foliage analysis Mitchell and Finn (1935) showed that P absorption tends to vary between genera but not between species; thus Sugar Maple extracts twice as much P from the soil as does Oak.

Deficiencies, Toxicities and Related Symptoms.

For purposes of comparison an enormous amount of data exists on the occurrence and range of the mineral elements in different species.

Wolff (1871 and 1880) reviews most of the literature prior to these dates, and a great amount of data can be found in the nutritional studies of Bauer (1910, 1911, 1912, 1913), Kübler (1912), Ramann (1892 and 1911), Czapek (1920), Hoppe (1901), Councler (1886), Gäumann (1938), and Schmitz-Dumont (1894), besides the litter references mentioned above. The distribution of Mn and Fe in various tree species has been investigated by Riou *et al.* (1936, 1937, 1938, 1939), Loew and Honda (1904), Bishop (1928) and Gutschick (1940). Generally the Fe and Mn contents of leaves and needles appear to be inversely related to each other. Data on Al may be found in Bertrand and Levy (1931), Robinson and Edgington (1945), Chenery (1946); on Zn in Bertrand and Benz (1929), Javillier (1908); on B in Agulhon (1910); on Mo in Bertrand (1940), various trace elements in Kessel (1940) and rare earths in Robinson (1943).

Numerous cases have been reported where the normal growth of trees has been upset by nutritional unbalance. Möller (1904), Němec (1936), Pessin (1937), Worley *et al.* (1941) and Hobbs (1944), have grown various species of hardwoods and softwoods under conditions of known mineral deficiencies and have described the resulting symptoms in detail. Deuber (1930), in a similar type of investigation, found that N and K deficiency symptoms became evident in the first year of growth, whereas P deficiencies only showed up in the second year.

Němec (1938–1943) has described a number of nutritional disturbances revealed by investigations into mature stands. By comparison of the nutrient status with that of healthy trees he has shown that

checking or even death may be associated with particular deficiencies or toxicities arising out of unfavourable soil conditions. Different species, of course, may react quite differently to the same environmental factors: Silver Fir, for example, has been shown to be particularly susceptible to K deficiencies, Larch to Mg deficiencies and Spruce to Ca deficiencies; on the same soil, therefore, it is quite possible for one species to grow satisfactorily whilst another may exhibit marked deficiency symptoms.

Checked growth of Scots Pine with yellow needles has been attributed to deficiencies in K and Mg together with toxic concentrations of Mn (1938*c*). Similar conditions have also been found in seedlings of Scots and Weymouth Pine and in 10-year-old White Pine showing abnormal needle colouring (1942*b*). Checking and death of Spruce has been attributed to disturbances in Ca and K nutrition associated with excessive absorption of Mn (1939*d*), to Ca deficiencies and excessive Mn and Al (1940*f*) and to P deficiencies (1939*e*). It is interesting to note that under conditions of Ca deficiency, Spruce may absorb greater quantities of K, Mg, Al and Mn in an effort to maintain a satisfactory base status and that, under these same conditions, Larch can make good growth with no signs of deficiencies (1940*f*). A low K content would appear to increase the susceptibility of Silver Fir to frost injury (1940*b*). Cases of checked growth in Beech have been ascribed to disturbances in the K and Ca status (1940*e*) and poor growth of Black Alder to Ca, Mg and P deficiences (1939*c*).

Manshard (1931) showed that Pine and Spruce seedlings were particularly susceptible to Cl toxicity arising out of the use of Cl-containing fertilizers, whereas hardwood seedlings were affected to a much smaller degree. The hardwoods themselves show a wide variation in their susceptibilities to Cl injury.

Rudolfs (1919) found that Maple was more sensitive to Cl injury than Birch, and Birch more than Oak. Strong (1944) investigated the relative Cl tolerances of a number of hardwoods and softwoods and found that *Quercus borealis*, *Q. alba* and *Ulmus americana* were fairly resistant. Harper (1946), working on the 'scored' leaves of various species, states that the susceptibility depends on the location of the leaves on the tree. Süchting (1939*b*) and Němec and Borisov (1941), have also investigated the effects of Cl-containing fertilizers on Spruce seedlings.

The effect of SO_2 in the atmosphere on trees growing in the vicinity of industrial plants has received a certain amount of attention. In the neighbourhood of a larger smelter at Trail, British Columbia, detailed studies have been made by Katz, McCallum, Lathe, *et al.* (1939) of the effects of SO_2 on vegetation. Katz and McCallum, who investigated the S content of a number of species, found Douglas Fir to be particularly sensitive to the presence of atmospheric SO_2. McCool and Johnson (1938) showed a significant decrease in the S content of a number of hardwoods with increase in distance from the source of SO_2 but found no adverse effect on the vegetation. Němec (1940*g*), on the other hand, ascribed the dying of Scots Pine trees to an excessively high content due to blast furnaces near by.

Nutrient Status and Yield.

Apart from the value of foliage analysis in the assessment of soil fertility or in the study of deficiencies and toxicities, there would appear to be a distinct relationship between mineral composition and quantitative tree growth. Mitchell (1934 and 1939) found not only that there was a high degree of correlation between the concentration of a particular element in the foliage and that in the external medium, but also that seedling yield was closely correlated with the internal concentration. The two variables, yield and mineral composition, could in fact be connected by a mathematical equation based on Mitscherlich's law. For each element there appeared to be an optimum or critical concentration e.g. N, 2·5 to 3·26; P, 0·5 to 0·67; K, 1·5 to 1·72; Ca, 0·28 to 0·33 per cent. of dry weight, associated with optimum growth of *Pinus strobus* seedlings. Mitchell and Chandler (1939) showed that N-tolerant spp. were able to grow on N-deficient soils owing to a higher per cent. of N in the leaves in relation to this optimum value as compared with other species.

Gast (1937), working on somewhat similar lines, established a log-log relationship between N supply and dry weight of *P. strobus* seedlings. Since there was a constant relationship between external and internal concentration of N, it followed that the internal concentration could be related to yield. Chapman (1941), in his work on Rubber and Oil Palm, found that in each mature leaf-whorl of the seedling, the N and P contents were related to leaf weight. When the entire plant was considered, the growth rate could be correlated with the P content of the leaves but the correlation between yield and leaf N varied with the season, being sometimes high and at other times insignificant. The relationship between leaf composition and growth rate was found to be associated with the leaf content of the deficient element. Hardy *et al.* (1935) used data on leaf composition to ascertain the nutrient requirements of *Cacao* and Grapefruit. Their technique included statistical comparison between

yields, growth-increment data and chemical composition, and the nutrient ratios in the leaf were found to be of great value. Finn and Tryon (1942) found that the growth of Red Oak was closely correlated with the internal concentration of N and P in the leaves but not with that of K.

Mitchell (1939) points out a striking similarity in the optimum concentrations of the elements, particularly for forest trees. Thus the optimum concentration for White Pine seedlings (or their needles) is essentially the same as that for the leaves of nearly mature deciduous spp. growing under natural conditions.

He distinguishes four degrees of nutrient status: (1) a minimum region where a particular element is limiting, (2) a working region which is equivalent to that found under natural conditions, (3) a region of tension where an increase in the element has no effect on growth and (4) a region of toxic concentration. In the application of such relationships to the role of a particular element it is therefore essential that growth is not limited by other elements. In his N experiments, Gast (1937) checked the P and K factors by calculating the ratios of the concentrations of P and K in the tissues with respect to the N concentration, and then compared this N : P : K ratio with that obtained by previous workers (Manshard, 1933; Bauer, 1910). From the comparison he concluded that seedling growth was limited only by the N supply.

Trace Elements.

Baker and Smith (1910), in a study of Australian trees, concluded that Mn was essential for the growth of Pine and suggested that an excess or deficiency of Mn in the soil may help in governing the distribution of certain species. Kessel and Stoate (1936), investigating the nutrition of *Pinus pinaster* and *P. radiata* showing unsatisfactory growth, found no significant difference in the nutritional status of healthy and unhealthy trees, but young Pines affected by rosetting responded strikingly to spraying with Zn compounds. An increase in Zn content towards that in healthy specimens was later shown by spectrographic analysis (Kessel and Stoate, 1938). Neilson-Jones (1938) suggested that needle fusion in *Pinus contorta* may be due to Zn and B deficiencies. Ludbrook (1939) found a deficiency of Ag in the needles of Pines suffering from fused-needle disease, but application of Ag had no effect; in fact, excessive applications of Ag and B were found to produce unhealthy seedlings. Requirements for B were demonstrated by Ludbrook (1940), who noted the incidence of needle fusion in *Pinus radiata* and *P. taeda* grown in cultures deficient in B. Smith (1943) demonstrated by a series of pot cultures the essentiality of Zn, Mn, Cu and possibly Mo for the normal development of *Pinus radiata*. Chlorosis of Beech on limy soils, due to the immobilization of Fe, is a common phenomenon (Day, 1947), and Willow also appears to be particularly susceptible to Fe deficiencies.

Gutschick (1940) emphasizes the importance of Ca in the soil in determining the Mn status of trees.

Conclusions.

Experience in the technique of foliage analysis applied to studies on the mineral nutrient relationships of forest trees, has shown that in many cases this technique can be of great value not only in the nursery but also in the mature stand. There are obvious advantages to be gained by following the responses of seedlings to various fertilizer treatments or the nutrient status of mature trees after silvicultural operations. Attention, however, must always be paid to the variations in mineral composition which may occur with age, season and the location of the leaves or needles on the tree, particularly in diagnostic investigations where special precautions appear necessary in the choice of comparable material. The complex inter-relationships involved between tree and site necessitate careful choice of analytical techniques. Many of the controversial results of experiments into the nutrient status of trees as determined by that of the site, may be due to differences in the methods of soil analysis employed. It has often been found necessary to employ different techniques for particular elements before satisfactory correlations can be achieved, and a great deal of work still remains to be done in the field of soil fertility assessments with regard to forest tree growth. As yet no entirely satisfactory scheme of soil analysis exists, by which alone the potentialities of a given site can be foretold with sufficient accuracy. Complementary investigations such as Nebauer tests or the analyses of existing vegetation would appear to be necessary for a more complete appreciation of the existing conditions.

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ABSTRACT SECTION

NOTE.—A capital letter in square brackets following the reference denotes the language in which the paper is written. A small letter denotes a summary in another or the same language, e.g. [G.e.]—German, with English summary. English [E.] is only indicated for papers published in journals usually written in foreign languages.

The term "billion" used in papers originating in North America means a thousand million.

0. GENERAL FORESTRY

02. DICTIONARIES AND LISTS OF VERNACULAR NAMES

See also *For. Abstr.* 9 (Nos. 2100, 2103).

[2000]. 02.4. GARCIA-PIQUERA, C. **A Spanish - English glossary of forestry terminology. II.** *Carib. For.* 8 (4), 1947 (269–88).

[2001]. 02.41 (914). TAMESIS, F. **Official common names of trees and other plants (as adopted by the Bureau of Forestry [of the Philippines]).** *Philipp. J. For.* 5 (1), 1947 (75–135).

04. MAPS

[2002]. 04.4. (73). FUECHSEL, C. F. **Topographic mapping in the United States.** *J. For.* 45 (11), 1947 (787–92).

A brief account of the area of the country surveyed, scales and kinds of maps available, and availability of air photographs.

05. PERIODICALS

[2003]. 05.4 : 11.43 : 12.21 : 13.2 : 44.4. **Annual review of microbiology.** Annual Reviews Inc., Stanford, Calif., Vol. 1, 1947. pp. 404.

This new publication is to provide annual reviews of the more active fields of research. It is intended that the reviews should be critical appraisals rather than mere compilations of the literature. This first volume covers the following subjects:—

Morphology and cytology of protozoa; Antigenic variation in protozoa and bacteria; Life cycle of malarial parasites; Variation in phytopathogenic fungi; Variation in phytopathogenic viruses; Some aspects of the problem of growth factors for protozoa; Bacterial metabolism; Nitrogen metabolism; Industrial fermentations; Quaternary ammonium compounds; Antibiotics; Chemotherapeutic agents; Immunochemistry; Some aspects of active immunization; Medical and epidemiological aspects of enteric infection; The rickettsiae; Respiratory viruses.

06. CONFERENCES. PROPAGANDA

See also *For. Abstr.* 9 (No. 2056).

[2004]. 06.2 (97). **Fifth British Empire Forestry Conference, Great Britain, 1947: summary report, resolutions and reports of committees.** H.M. Stationery Office, London. 1947. pp. 56.

[2005]. 06.6 : 97.2. TRENK, F. B. **Timber harvest tracts advance farm forestry.** *J. For.* 46 (1), 1948 (31–4).

The use of small publicly owned demonstration forests is recommended in areas where woodlands are, or could be, of importance in farm economy. Such a scheme in Wisconsin is described. A feature of the scheme is holding 'harvest field days' which demonstrate the harvesting of current increment and net hourly wages, instead of income per acre, which has been, in the author's opinion, too long used for appraising the productive value of farm woods.

07. EDUCATION AND RESEARCH. TRAVEL

See also *For. Abstr.* 9 (Nos. 2056, 2222, 2338).

[2006]. 07.1 (54) : 05.3. INDIA. **Quinquennial report of the Indian Forest College, Dehra Dun, 1941–42 to 1945–46.** 1947. pp. 19.

[2007]. 07.1 (52). HUBERMAN, M. A. **Forestry education in Japan.** *Rep. Brit.*

Intell. Obj. Sub-comm. No. B.I.O.S./J.A.P./P.R./1157, 1946. pp. 23 + 2 tbls. P.R.

Describes the Japanese system of forest education carried out by departments of forestry at the 4 Imperial universities, and 13 professional schools of agriculture and forestry, discusses the 3-year curriculum of the Kyoto Imperial University Department of Forestry and lists the Japanese and foreign text-books generally used. [Cf. *For. Abstr.* 8 (No. 2238).]

[2008]. 07.1 (79) : 81. McCULLOCH, W. F. **The work and education of industrial foresters in the Pacific Northwest.** *J. For.* 45 (11), 1947 (783–6).

[2009]. 07.2 (410). LAURIE, M. V. **Forest research: Forestry Commission Research Station at Alice Holt, Surrey.** *Wood* 12 (10), 1947 (281–2).

[2010]. 07.2 (498) : 92. BĂLĂNICĂ, T. Legea I.C.E.F.-ului. [**The law of the Forest Research Institute of Rumania.**] *Rev. Pădurilor* 62 (7/9), 1947 (119–25). [Rum.f.]

Account of Law No. 173 of June 5th, 1947, for the reorganization of the Institute with research, educational, and administrative functions. There are 6 experiment stations attached to the Institute and situated in different parts of the country. The law gives the status of University teachers to the staff of the Institute.

[2011]. 07.2 (676) : 05.3. **East African Agricultural Research Institute, Amani: Report for the years 1942–45.** H.M. Stationery Office, London. 1946. pp. 43. *Colonial* No. 203.

[2012]. 07.2 (711) : 07.6. **The Cowichan Lake Forest Experiment Station: a brief description of its purpose, development, and environment.** British Columbia Forest Service. 1947. pp. [24] + map.

[2013]. 07.2 (713). **The Petawawa Forest Experiment Station.** Dominion Forest Service, Ottawa. 1947. pp. 25.

A description and history of the station, which was established in 1917, together with a summary of problems under investigation and a list of projects.

[2014]. 07.2 (75) : 05.3. **Anniversary Report 1921–46: Twenty-five years of forest research at the Appalachian Forest Experiment Station.** Southeastern Forest Experiment Station, Asheville, N.C. [1947.] pp. 71.

[2015]. 07.8 (72) : 07.5. RICKETT, H. W. **The royal botanical expedition to New Spain.** *Chron. bot.* 11 (1), 1947 (1–86 + plates).

A reconstruction from the Mexican national archives of the history of the Royal Botanical Expedition which was sent out by Charles III in 1787 to study the flora of New Spain. The foundation of the Botanical Garden in Mexico in 1788, its work, and the travels of the expedition in Mexico, Central America and the West Indies are described.

09.1. *Forest History*

See also *For. Abstr.* 9 (Nos. 2029, 2149, 2647).

[2016]. 09.1 (415). FORBES, A. C. **The forestry revival in Eire.** *Irish For.* 4 (1), 1947 (11–26).

[2017]. 09.1 (591) : 12.26–8. STEBBING, E. P. **The Teak forests of Burma.** *Nature, Lond.* 160 (4076), 1947 (818–20).

[2018]. 09.1 (914). SULIT, C. **Forestry in the Philippines during the Japanese occupation.** *Philipp. J. For.* 5 (1), 1947 (22–47).

09.4. *Forest Statistics*

See also *For. Abstr.* 9 (Nos. 2327, 2386, 2406, 2498, 2500–02, 2639).

[2019]. 09.4 (470). POPOV, V. A. Itogi i blizhayshie perspektivy. [**Results and immediate prospects.**] *Lesnaya Prom.* 1947 (4), (2–6). [Russ.]

A review of progress in logging and the wood-using industries under the current 5-year Plan.

[2020]. 09.4 (481) KRAEMER, J. H. **Forest resources and lumber industry of Norway.** *J. For.* 45 (10), 1947 (723–8).

[2021]. 09.4 (485). HAGBERG, E. Den andra riksskogstaxeringen av Norrland: översikt av under olika år taxerade områden samt uppgift om hittils avlämnade rapporter, redogörelser och publicerade resultat. [**The**

second State Forest Survey of Norrland: conspectus [with map] of the areas surveyed in the different years and of the published and unpublished reports, etc. [indicating where these are available].] *Norrlands SkogsvFörb. Tidskr.* 1943 (4), (444–6). [Sw.]

[2022]. 09.4 (489). KRAEMER, J. H. **Forest resources and lumber industry of Denmark.** *J. For.* 45 (11), 1947 (799–803).

[2023]. 09.4 (51) : 60.31 : 32.9. CHOW, C. K. **Kansu forest resources and timber supply.** *Bot. Bull. Acad. Sinica* 1 (4), 1947 (322–32 + maps).

The three main forest regions of Kansu province are studied from the point of view of present resources and timber supply. The regions are subdivided into smaller units for the purpose, and stand tables are given showing the number of trees of different species and their d.b.h. in an average acre of each unit. Grades of timber produced and transport methods in some of the areas are also described. The total forest area of Kansu is 2,330 sq. miles and the volume of standing timber 4,153,656,500 cu. ft. A table shows for each unit the area of forest land, number of trees over 3 in. d.b.h. and volume of standing timber in cu. ft. The forests are now being destroyed by over-exploitation. The author pleads for a rational system of management and reforestation. [Cf. *For. Abstr.* 9 (Nos. 2031, 2134–5).]

[2024]. 09.4 (573) : 97.4. NEVZOROV, N. V. Budushchie tsentrȳ lesnoy promȳshlennosti Vostochnoy Sibiri. [**Future centres of the forest industry of E. Siberia.**] *Lesnaya Prom.* 1947 (7), (3–6). [Russ.]

Tabulates and discusses data, so far as available, for the Angara-Lena region of E. Siberia, where it is planned greatly to increase exploitation and to create forest industries at suitable centres. It is estimated that there is an area of 5·9 million ha. carrying about 1·1 milliard cu.m. of exploitable timber, in which annual fellings of 14–15 million cu.m. could be made. Over most of the area the percentage of mature and overmature stands is 50–66. The chief species, in order of exploitable supplies, are Scots Pine, Larches, Spruces, Birches, Aspen and Siberian Pine.

Before organized exploitation can begin, further and more exact aerial and ground surveys will be necessary, followed by detailed planning for the development of the industries envisaged, with particular reference to their location and communications.

[2025]. 09.4 (71) : 98. **Statistical record of the forests and forest industries of Canada.** Dominion Forest Service, Ottawa. 3rd ed., 1947. pp. [3] + 22 tbls. + 22 charts.

[2026]. 09.4 (73) : 98.1. **Gaging the timber resource of the United States.** *Reappraisal Rep. U.S. For. Serv.* No. 1, 1946. pp. 62.

Working from estimates of present drain and potential requirements for forest products, this report proposes goals towards which timber growing should be directed. It then shows that there is plenty of forest land in the U.S.A., and that the deficiency lies mainly in the inadequacy and poor distribution of the growing stock. It supplements evidence of the deteriorated condition of the growing stock in many regions by discussion of how the major forest industries are affected, and gives the main facts about forest ownership. The appended tables give land area by major uses, commercial forest area by character of growth; volume of sawtimber and of all timber on commercial forest land, volume of sawtimber by species; ownership of commercial forest land, ownership of sawtimber; current annual growth, total annual drain, annual drain by commodities and destructive agents, annual drain from all timber and from sawtimber by major items; future growth rates and growth objectives, possible future course of sawtimber drain, trends of sawtimber growing stock; all of these by regions.

[2027]. 09.4 (73) : 98.1. **Potential requirements for timber products in the United States.** *Reappraisal Rep. U.S. For. Serv.* No. 2, 1946. pp. ii + 70.

[2028]. 09.4 (73) : 98.1. DIETZ, M. A. **A review of the estimates of the sawtimber stand in the United States, 1880–1946.** *J. For.* 45 (12), 1947 (865–74).

Attempts to determine trends in timber depletion by comparing past estimates of standing timber have frequently been unsatisfactory owing to changes in standards of merchantability, of accessibility, and of accuracy in the estimates themselves. The writer

reviews the several estimates, outlines the standards used, and discusses their relative reliability. The estimates of 1945 for certain regions of the U.S.A. for which comparable earlier figures are available show a 14-per-cent. decline in standing sawtimber during a period of about 11 years.

09.7. *Monographs of Individual Forest Regions*

See also *For. Abstr.* 9 (Nos. 2103–5, 2193–4).

[2029]. 09.7 (410) : 94.11. **Report of the New Forest Committee.** Forestry Commission. 1947. pp. 104 + map. *Cmd.* 7245. Price 3*s.* 6*d.*

The report has sections on the following subjects:—history, area, administration, the woodlands of the forest, the open forest, the commoners and their rights, the open forest and amenities, planning and roads. The appendices include an account of receipts and payments by the Forestry Commission in the New Forest for 1937–9, analysis of the Verderers' accounts, and the distribution of conifers and hardwoods by age classes in 1929. Its recommendations include:—Adequate shelter for forest labourers when working in the open; the Court of Verderers should be reconstituted, with enlarged powers, under the name of Council of Verderers, and the Court of Swainmote should likewise continue to exercise judicial functions with necessary enlargements; a single new Rural District Council with authority over the whole area of the Forest and certain adjoining districts, which should be the planning authority for the Forest. Natural regeneration and artificial regeneration in small groups should be practised in preference to large-scale plantations, due weight being given to amenity. Existing conifer plantations should be disguised by careful planting of broadleaved species on their borders or in neighbouring groups. The public should be allowed the greatest reasonable freedom of access to enclosures, grids being installed wherever possible and gates made self-closing. To ensure that scientific interests shall not be adversely affected by drainage, burning, plantation or other changes, the whole Forest, open and enclosed, should be declared a nature reserve, and a curator with scientific knowledge appointed by the Verderers, to be answerable to them for the protection of scientific interests over the whole area of the Forest.

[2030]. 09.7 (46) : 12.26–8 : 22.2 : 31.0. Riu Vulart, J. M. Los encinares del Montseny o los rayos y pinas de encina Catalana. [**The Holm Oak forests of Montseny; spokes and felloes from Catalan Oak.**] *Publ. divulg. Cám. of. agríc. Barcelona* No. 3, 1945. pp. 63. [Span.]

A detailed description of the Holm Oak (*Quercus ilex*) forests of Barcelona province with an account of their management and exploitation. The Oak stands of Montseny are worked as coppice, since *Q. ilex* is a vigorous coppicer and grows straight clean wood by this method. The rotation varies with the type of soil and rapidity of growth, but should not be less than 10 or more than 20 years. Two cleanings between cuts are recommended, viz. 6–7 years after each cut, and one year before the next. Instructions for pruning are given. The greater part of the wood from the Barcelona Holm Oak forests is used for firewood and charcoal, and some for distillation. Sound timber is valuable chiefly for wheelwrighting; also for tool handles, farm implements and shuttles.

[2031]. 09.7 (51) : 8. Kiong, P. T. La sylviculture en Chine. [**Forestry in China.**] *Rev. int. Bois* 14 (125), 1947 (195–206). [F.]

Contains (1) a fairly full account of forest administration, (2) forest area and brief descriptions of the principal forest regions, (3) list of principal forest species. [Cf. *For. Abstr.* 9 (Nos. 2023, 2134–5).]

[2032]. 09.7 (569.5). Chapman, J. D. **The forests of Transjordan.** *Emp. For. Rev.* 26 (2), 1947 (245–52 + plates + map).

[2033]. 09.7 (596–9). Rothe, P.-L. Forêt d'Indochine. [**The forests of Indo-China.**] *Bois For. Trop.* Nos. 1; 2; 3, 1947 (25–30; 18–23; 17–23 + plates). [F.]

Describes the main forest types, gives an account of the history of former treatment of the forests, and discusses the possibilities of exploitation in the future. [Cf. *For. Abstr.* 9 (No. 2324).]

[2034]. 09.7 (675). Straeten, E. van der. Les forêts du Congo Belge. [**The forests of the Belgian Congo.**] *Rev. int. Bois* 14 (125), 1947 (207–13). [F.]

[2035]. 09.7 (728.4) : 91. McKinley, T. W. **Some observations on conservation of natural resources of El Salvador.** *J. For.* 45 (10), 1947 (755–61).

[2036]. 09.7 (8) : 90. Huberman, M. A. **Our good neighbors' forestry.** *J. For.* 46 (2), 1948 (81–98).

The author reports on a quick trip round South America during which he visited 11 countries, gives a brief account of the state of forestry in each, and suggests the lines on which F.A.O. might help them with technical aid and advice.

[2037]. 09.7 (86) : 33.1 : 35 : 90. **The forests of Western and Central Ecuador.** U.S. Forest Service, Washington, D.C. 1947. pp. 134 + maps.

Cf. *For. Abstr.* 9 (No. 42).

[2038]. 09.7 (944) : 31.0 : 12.19.2. **Forest resources, regions and trees of New South Wales in brief.** Forestry Commission of New South Wales. 1947. pp. 16 + map.

1. FUNDAMENTAL NATURAL LAWS OF THE FOREST

11.1. *Atmosphere*

11.15. Light

See also *For. Abstr.* 9 (Nos. 2093–5).

[2039]. 11.15 : 01.4 : 24.4. Linde, R. J. van der, and Woudenberg, J. P. M. Een methode ter bepaling van het dagelijksch verloop van de breedte van de schaduw in verband met den tijd van het jaar en de orientatie van het beschaduwende object. **[A method for determining the daily variation in shadow length in relation to time of year and the orientation of the object casting the shadow.]** *Meded. Inst. toegep. biol. Onderz. Nat.* No. 4, 1946. pp. 6 + 5 gphs. [Du.E.]

In connexion with work on the influence of shelterbelts on microclimate, the authors have devised a graphical method, involving no special field observations, for determining the length of a shadow at any time of day and on any day of the year.

Two graphs, one for winter-spring and one for summer-autumn, show the daily variation in altitude and azimuth of the sun for the latitude of Amsterdam, and a transparent overlay is provided on which are drawn lines of equal s/h (shadow length/height of object). After adjusting the alignment of overlay and basic graph in accordance with the orientation of the object casting the shadow, the s/h ratios can be read off at the appropriate intersections.

Two examples are given in illustration of the method.

[2040]. 11.15 : 65.7 : 12.25. Wellner, C. A. **Light intensity related to stand density in mature stands of the Western White Pine type.** *J. For.* 46 (1), 1948 (16–19).

The use of partial cuttings in mature stands of the Western White Pine type has introduced the need for a method of estimating light intensity beneath the canopy. A workable method of estimating light intensity is to relate it to measures of stand density. Figures are given, based on light intensity determinations in a number of uncut and cut-over mature stands of the White Pine [*Pinus monticola*] type, relating light intensity to two measures of stand density: (1) summation of diameters per acre, and (2) basal area per acre. These relationships are given for 3 stand-composition classes. The figures and a derived table should prove a useful guide in deciding how heavily to cut a given stand in the Western White Pine type to obtain light intensities necessary for *Ribes* suppression in blister-rust control or for natural regeneration of desired species. *Author's summary.*

[2041]. 11.15 : 91.3 (754). Allard, H. A. **Light intensity studies in Canaan Valley, West Virginia.** *Castanea* 12 (3), 1947 (63–74).

A study of summer light conditions made with a portable light meter in secondary hardwood forests lying between the Allegheny Front and the Canaan Mountain rim in West Virginia. The highest incident sunlight intensities for the period August 11th to August 14th, averaged about 8,800 ft. candles. Considering only sunny days and the Beech/Maple or hardwood forest cover, the average ratios of outside illumination to that of the heaviest shade varied as 1 : 0·003. Results of the studies are given in detail and discussed.

11.2. *Climate and Microclimate*

See also *For. Abstr.* 9 (Nos. 2609–10, 2651–2).

[2042]. 11.2 : 11.11.4 : 11.62.1 (73). TANNEHILL, I. R. **Drought: its causes and effects.** Oxford University Press. 1947. pp. 264. Price 15*s*.

11.4. *Soil*

[2043]. 11.4 (91) : 11.62.11 : 12.26–8. EDELMAN, C. H. Studiën over de bodemkunde van Nederlandsch-Indië. [**Studies on the soil science of the Netherlands-Indies.**] *Publ. Stichting 'Fonds Landbouw Export Bureau 1916–1918', Wageningen* No. 24, 1941. pp. 416. [Du.]

A comprehensive review of relevant literature, comprising chapters on: the development of soil research in the Netherlands Indies; the component parts of soils and the relationship between them; factors (climate, topography, plants and animals, man, etc.) affecting the soil; classification, terminology and mapping of Indies soils; regional research; soil fertility; important soil elements and fertilizers; soil science in relation to rice, sugar-cane, tobacco, and other crops, including coffee, cacao, tea, rubber, cinchona, oil and Coconut Palms; forest soils (dealing mainly with Teak stands); soil erosion; irrigation; plant diseases; and plant breeding. There is a bibliography of over 100 pages divided into 3 sections, by date.

11.41. Soil Physics

See also *For. Abstr.* 9 (Nos. 2111, 2608, 2629).

[2044]. 11.41 : 02.1. BAVER, L. D. **Soil physics.** John Wiley and Sons, Inc., New York. Chapman and Hall, London. 1940. pp. xi + 370.

11.42. Soil Chemistry

See also *For. Abstr.* 9 (Nos. 2047–50, 2055).

[2045]. 11.42.1 : 12.11.11. MITCHELL, R. L. **Trace constituents in soils and plants: their significance and spectrographic determination.** *Research, Lond.* 1 (4), 1948 (159–65).

11.43. Biology of Soil, including Mycorrhiza

See *For. Abstr.* 9 (Nos. 2003, 2536).

11.44. Litter. Surface Humus

See also *For. Abstr.* 9 (Nos. 2051–2).

[2046]. 11.44 : 12.21. LINDEBERG, G. Über die Physiologie ligninabbauender Bodenhymenomyzeten. Studien an schwedischen *Marasmius*-Arten. [**On the physiology of lignin-decomposing soil hymenomycetes. Studies on Swedish *Marasmius* species.**] *Symb. bot. upsaliens.* 8 (2), 1944. pp. 183. [G.e.]

Deals with the decomposition of litter by common *Marasmius* species, in particular with their effect on lignin and cellulose, and examines the conditions for their growth, paying special attention to the dependence of the fungi on growth substances, and to the conditioning of their growth by the concentration of hydrogen-ions and the content of calcium, manganese and zinc in the medium. There are 24 figures and 54 graphs in the text. *From author's summary.*

[2047]. 11.44 : 12.26–8 : 11.47.2 : 11.42.3. BOUDRU, M. Influence de l'introduction des feuillus sur la couverture morte et le sol, au Dilserbosch. [**Effect on litter and soil of the introduction of broadleaved species in the Dilserbosch.**] *Bull. Soc. for. Belg.* 53 (10), 1946 (406–9). [F.]

Cf. *For. Abstr.* 9 (No. 2054). The buffer action of the litter and the soil in the Dilserbosch was studied, using a modified form of Hesselman's technique. It was found that the influence of the broadleaved species was revealed in a significant improvement in the following respects: (1) a reduction in the depth of the L-layer, i.e. a more rapid and complete decomposition of litter than occurs under conifers; (2) the litter is less acid, requiring only small quantities of bases in order to be completely neutralized. The extreme poverty of the soil in this area (a siliceous skeletal soil) can only be enriched by the diffusion of organic matter, and some degree of such diffusion seems to be attested by the slightly higher buffer action of the soil under broadleaved species.

[2048]. 11.44 : 12.25–8 : 11.47.2 : 12.11.11. BOUDRU, M. À propos de certaines propriétés des feuilles et aiguilles mûres de nos arbres forestiers en liaison avec leur pouvoir améliorant. [**Certain properties of mature leaves and needles of our forest trees in relation to their power as soil improvers.**] *Bull. Soc. for. Belg.* 54 (3/4), 1947 (129–62). [F.]

The soil-improving properties of the leaves and needles of forest trees have been variously attributed to different factors, e.g. balance of consumption and restoration of mineral substances, pH, buffer action, production of CO_2, lignin/cellulose ratio, and silica/calcium ratio. The author discusses these, reviews the literature, reproduces tables from various publications showing the above-mentioned properties for the principal Belgian forest species, and concludes that none of these factors alone can explain the intensity of soil improvement. He makes a particular study of the speed of decomposition, which depends on the species as well as the environment. A series of tests and field observations make it possible to classify the species considered, according to rapidity of decomposition. Particular emphasis is laid on the extremely rapid decomposition of the leaves of the Elms, Ash, and the Alders, the inferiority of Beech in this respect, and the superiority of Oak to Beech on biologically inactive soils. *From author's summary.*

[2049]. 11.44 : 12.26–8 : 11.42.1. BOUDRU, M. Influence des essences sur le pouvoir-tampon de la couverture morte et du sol. [**The effect of different species on the buffer action of litter and soil.**] *Bull. Soc. for. Belg.* 54 (8), 1947 (298–307). [F.]

Investigations made in the forest of Soignies showed that the litter under Beech and Spruce is acidifying, while the litter and humus under Ash, and particularly Elm, shows a reduction in acids, and basic materials are well represented in spite of leaching.

[2050]. 11.44 : 12.26–8 : 11.42 : 11.47.2 : 12.11.11 : 23.51. DUCHAUFOUR, P. Le hêtre est-il une essence améliorante? [**Is Beech a soil-improving species?**] *Rev. Eaux For.* 85 (12), 1947 (729–37). [F.]

It is much disputed whether Beech produces mull or mor soils. The author briefly sets out both theories, and the facts on which they are based. Even on soils poor in calcium, the Beech accumulates in its leaves calcium derived by its roots from lower levels, and thus, owing to its very abundant litter, helps to neutralize leaching of bases, and particularly of calcium. The calcium content of Beech leaves is relatively high compared with that of Oak leaves; their pH is 5·3–6·6, whilst that of Oak leaves is only 4·8. Some account is given of measurements of exchangeable calcium and of pH in Beech woods with mull soil on a non-calcareous subsoil. It was found that the pH of the A_1 horizon was always higher than that of the A_2 horizon, just the reverse of what occurs in a pure Oak stand. In a mixed Oak/Beech wood (50 per cent. of Beech in the dominant storey) the pH of horizon A_1 was significantly raised by the contribution of Beech litter and the exchangeable calcium content was almost double that of horizon A_2.

On the other hand, the extreme slowness of decomposition of Beech leaves owing to their chemical composition, is well established, and the cellulose/lignin ratio is particularly low (Beech 16/22, Oak 22/10). Moreover, though the average calcium content of the leaves is high, it varies widely with the calcium content of the subsoil.

It appears, therefore, that there is a balance of inherent factors favourable and unfavourable to the formation of a mull soil. The favourable factors are the abundance of litter and its relatively high calcium content, the unfavourable are the resistance of the leaves to bacterial action, caused by a high lignin content, and the variability in calcium content and therefore of pH. Hence, the great importance of the two environmental factors of climate and subsoil. In a mild, moderately humid climate, the conditions for bacterial activity are at an optimum, whereas, in a very humid or cold climate, bacterial activity is slowed down, the decomposition of litter takes longer, calcium is progressively leached out, and an acid mor soil of lamellar structure is formed. On a mineral soil relatively rich in exchangeable calcium (brown and feebly leached soils), the final product of humification will always be richer in calcium than that on a subsoil poor in calcium, whether that poverty be inherent in the parent rock (as in the Vosges sandstones) or the result of previous leaching of the bases by pedological processes (podzolic soils or podzols). These factors of climate and soil may work in the

same or in opposite directions, thus producing intensified or neutral effects as the case may be. These effects are shown in the following table:–

Climate	*Soil*	*State of humus*	*Examples*
Mild (lowland).	Brown forest soil, with little leaching.	Mull.	Most of the forests of the middle Loire.
Mild (lowland).	Podzolic or podzol.	Tendency to acidification.	Forest of Ecouves over Silurian quartzites.
Humid, mountain.	Yellow with little leaching; parent rock rich in bases.	Distinctly acid.	Beech woods on granites.
Humid, mountain.	Poor in exchangeable bases.	Accentuated acidification.	Beech woods of the Vosges (sandstones); Finistère (primary sandstone).

It is concluded that Beech forms a mull on calcareous soils in all conditions, and also on non-calcareous soils in a mild, moderately humid climate, provided that the subsoil is not much leached and not very acid. In these circumstances Beech is very beneficial in preventing acidification of the soil. On the contrary, in a mountainous or a very humid (e.g. Breton) climate, and on poor, already acid soils, Beech can only accentuate acidity and accelerate leaching, and is therefore decidedly harmful. It is particularly recommended that it should not be used for underplanting conifers, especially Pines, which are frequently growing on soils already much leached and poor in calcium, and the litter of which discourages bacterial activity. An underplanting choice is difficult, since species whose leaves are readily decomposable are usually light-demanding. The most hopeful are *Alnus incana*, *A. cordata* and *Robinia pseudoacacia*. *A. cordata* tolerates shade better than *A. incana*. Robinia has been successfully underplanted to Pine, but its thorniness is a drawback.

11.47. Maintenance of Favourable Soil Conditions

See also *For. Abstr.* 9
(Nos. 2047–50, 2061, 2190, 2201, 2536).

[2051]. 11.47 : 23 : 12.25 : 12.26–8 (485) : 11.49.0 : 11.48.2 : 11.44. TAMM, C. O. Markförbättringsförsök på mager sand: undersökningar på Mölna försöksfält nära Vaggeryd i Småland. [**Soil-improvement experiments on poor sands: researches on the Mölna experimental area, near Vaggeryd, Småland.**] *Medd. SkogsforsknInst., Stockh.* 36 (7), 1947. pp. 115. [Sw.e.]

The final report (earlier ones to 1938 were published by O. Tamm) on work begun in 1922 with the aim of discovering means for improving regeneration and yield on poor sandy soils in Småland. The soil at Mölna is a podzol on a glacio-fluvial sand which is very poor in mineral nutrients.

The chapters deal successively with : (1) Climate, geology and soil. (2) The forest and ground vegetation before clear felling in 1918–19. (3) Regeneration in 1922–23 by direct sowing and planting of Scots Pine and Norway Spruce, in some cases with Birch or Grey Alder as nurses to sowings; the treatments applied, viz. harrowing, liming, removal of slash, use of slash or of peat from Birch carr as fertilizers. (4) Plant growth and soil conditions, with special reference to ground vegetation. (5) Conclusions.

Mixing peat with the earth in planting holes was the most effective treatment and has significantly favoured both Pine and Spruce plants, the mean height of 20-year-old Pine so treated being 4·8 m., compared with 4·1 m. for untreated plants. The effect shows very gradually and is persistent.

A deep covering of slash also appears to have improved the health of the trees, though many of the latter have become bushier and the difference in height growth between these and controls is scarcely statistically significant. Such as it was, this effect lasted for a limited time only.

The remaining treatments had no demonstrable effect on growth. Any measures promoting rapid decomposition of the humus layer, including broadcast burning (done on a portion of the area), are considered dangerous on such sites: available soil nutrients are low, the quantities stored in the humus are valuable, but if set free rapidly they may easily be lost by leaching. Unless canopy is formed a few years after clear felling, impoverishment of the soil gives rise to poor open forest with a ground flora of *Calluna* and lichens, a condition very difficult to remedy. It is noteworthy that Pine seedlings appearing naturally immediately after the clear felling grew at least as well as those planted 2–4 years later, and considerably better than the plants used for beating up 4–8 years after formation of the plantations.

A close correlation was found to exist between the abundance of *Epilobium angustifolium* and other 'nitrate plants' and the decomposition of the humus layer (involving nitrification). In view of what has been said, such plants do *not* indicate favourable conditions for tree growth on these sites. Birch, on the other hand, was of some value as an indicator. The planted Birch (and the Alder) largely failed, but wherever self-sown Birch came in and throve, the Pine has also done well. Birch appears very sensitive to nutrient deficiency caused by excessive humus decomposition or an initially poor humus layer, and natural regeneration came up only during the first years after felling. It proved almost impossible to fill gaps in Birch by beating up. Birch seedlings also appear to be sensitive to root competition from older conifers, whereas Pine seedlings did not suffer much from root competition with Birch—a fact which may be due partly to the deeper root system of the Birch and partly to the favourable influence of its litter on the humus and soil.

The main cause of low yield on this type of soil is the poverty of the sand in nutrients. Locally, degeneration of the humus also contributes, leading to open Pine-heath with lichens. The forester's first aim should be to establish canopy rapidly, to keep it closed and to encourage an admixture of Birch. Further research is needed to show whether and to what extent it may be economically profitable to use peat or other fertilizers.

There is an English summary 9 pp. long, and titles of tables, etc. are also translated.

[2052]. 11.47 : 23.13 : 12.25 (485) : 12.19.2 : 22.11 : 38.6 : 11.44. HOLMBÄCK, B., and MALMSTRÖM, C. Några markförbättringsförsök på nordsvenska tallhedar. [**Some site improvement experiments on northern Swedish Pine-heaths.**] *Medd. Skogsforskn-Inst., Stockh.* 36 (6), 1947. pp. 82. [Sw.e.]

Cf. *For. Abstr.* 7 (No. 1719). The present paper describes experiments at Ruutirova, near Gällivare, and Andersforsheden, near Byske, the treatments including digging, broadcast burning, raking, shading, and irrigation with bog water, with the object of improving the survival and growth of Scots Pine natural regeneration. As noted in previous investigations, the seedlings respond with increased growth and a healthier colour after clear fellings, a reaction thought to be due primarily to changes in nutrient status (fertilizing effects from dead roots, felling debris, and improved decomposition of surface humus) and water supply (removal of root competition). This improvement is a temporary one, and the silvicultural problem is to secure a good young stand as soon as possible after felling, for if this can be done, the best soil conditions possible for such sites will be maintained by the litter-fall of the stand.

At Ruutirova, irrigation was followed by greatly improved growth of trees and seedlings, accompanied by changes in the ground flora. These responses lasted for various periods after irrigation had been discontinued, and are still noticeable in two areas not irrigated since 1928 and 1930 respectively. A number of facts suggest that the response was due to factors other than water supply as such, e.g. the persistence of the effects and the correlation between their duration and the depth of mud deposited by the irrigation water, the mud being rich in N (believed to be the most important factor) and mineral nutrients.

Effects of the remaining treatments were either inconclusive or were masked by changes due to fellings. Plots that were dug still show good growth in the young stands. For the first few years the burned plots appeared the most promising; later they suffered considerable damage from *Phacidium* [cf. *For. Abstr.* 9 (No. 2552)] and possibly other fungi, and their growth rate, though still good, is inferior to that on the dug plots. The causes of such improvements as occurred are believed to be largely of the same nature as those mentioned under clear felling.

Silvicultural treatment on the Pine-heaths should aim at achieving as abundant a litter-fall and as little root competition as possible from old growth. Really poor sites can be improved by sedimentation as at Ruutirova, though this measure will seldom be practicable. For neglected sites, originally of good quality, burning and soil cultivation effect only temporary improvement, and it is considered that manuring with peat or peat-mud is likely to be worth trying on a larger scale.

The illustrative matter is provided with English as well as Swedish legends.

[2053]. 11.47.13 : 11.49.5 (485) : 23.4. MALMSTRÖM, C. Skogliga gödslingsförsök på dikade svaga torvmarker. [**Forestry trials with fertilizers on poor, drained peatlands.**] *Norrlands SkogsvFörb. Tidskr.* 1943 (4), (273–92). [Sw.]

The history of Ålund's trials of wood ash as a fertilizer for drained sphagnum bogs in Västerbotten [see Malmström's account in *Medd. SkogsförsöksAnst. Stockh.* 28 (6), 1935] is briefly recapitulated. Following applications of wood ash at rates of respectively 3·3 and 12·5 metric tons per ha., plots on the Södra and Norra Hallmyrar—almost treeless bogs—first showed improvements in the ground flora and later developed thrifty young stands of spontaneous Birch with some Scots Pine and Norway Spruce admixed. An inspection in 1943 showed that the development of the young stands on these plots was highly satisfactory, with no sign of any relapse in growth, although no further applications of wood ash had been made over periods of 25 years in the one case and 17 years in the other. The unfertilized areas were still practically as poor as ever.

Brief notes are also included on similar trials on other bogs, where the same initial improvements have been noted, though it is as yet too early for any conclusions regarding the future of the trees that are now colonizing the fertilized areas. Among such trials, those on the Flakatjälsmyr in Kulbäcksliden are specially mentioned. Here plots on drained and undrained areas, fertilized in 1939 with wood ash, show improvements in ground vegetation and stocking by spontaneous tree seedlings on both types of site. In 1941 more extensive trials were begun by L.-G. Romell, using a basic chemical fertilizer mixture, with or without phosphate and various trace elements. So far the complete fertilizer has given the best results, followed by the basic mixture plus phosphate. As treatments with soda lye, sodium chlorate or nitrogenous fertilizer have shown no sign of comparable effects, it is inferred that the favourable reaction to wood ash or chemical mixtures is due to direct fertilizing and does not depend on general base relationship, poisoning out of sphagnum, or hastening of peat decomposition. Phosphorus is indicated as one of the most important needs.

The long duration of the effects of wood ash in Ålund's trials is believed to be due to retention of nutrients by the peat colloids. How long such effects may last is unknown, but clearly some further fertilizing will eventually be necessary, as it will in the case of many drained bogs which were at first sufficiently rich in nutrients to grow forest without fertilizing.

The chief difficulty in the fertilizing of bogland would be to procure the wood ash or other suitable fertilizer. Transport and spreading are easiest when the bogs are frozen and slightly snow-covered.

[2054]. 11.47.13 : 22.83.1 (493) : 47. DELEVOY, G. Le Dilserbosch en 1941. [**The Dilserbosch [plantations] in 1941.**] *Bull. Soc. for. Belg.* 53 (10), 1946 (385–405 + plate). [F.]

These plantations of mixed conifers (Scots, Weymouth and Corsican Pines) and broadleaved species (Spanish Chestnut and Red Oak) were established in 1902, managed partly as selection forest and partly as coppice with standards and given different amounts and mixtures of chemical fertilizers (chalk, kainite and basic phosphate). They were measured in 1933 and partially remeasured in 1943. Special attention is given to the remarkable resistance of these mixed stands to unfavourable factors, not only insect and fungus attack, but also windthrow and, particularly, fire. The whole plateau on which they are situated was in 1940 swept by fire which completely destroyed the extensive Pine woods, but the mixed stands suffered no serious harm. Average annual increment varied from 4·8 to 7·7 cu.m. between the ages of 30 and 40. Natural regeneration of the broadleaved species appears to be assured and that of the conifers possible. The most satisfactory form of management seems to be an intense selection system. The effect

of the application of fertilizers at the time of planting was still apparent after 40 years, and was indeed even more marked than at 30 years. The dosage should be varied according to the species planted, e.g. the proportion of kainite should be increased for *Quercus borealis* and that of chalk for *Pinus nigra*. [Cf. also *For. Abstr.* 9 (No. 2047).]

[2055]. 11.47.13 : 11.42 (595). OWEN, G. **Retention of phosphates by Malayan soils. I. The nature of phosphate retention in different soil types.** With statistical appendix on correlation of phosphate retention with clay, silica, iron and aluminium, by H. Fairfield Smith. *J. Rubb. Res. Inst. Malaya* 12 (262), 1947. pp. 46.

11.6. *Hydrographical Conditions. Water and Soil Conservation*

See also *For. Abstr.* 9
(Nos. 2042–3, 2196–7, 2211, 2651–2, 2665).

[2056]. 11.6 (676) : 06.2 : 07.2 : 97.1. **[East African] Agricultural Research Conference, Nairobi, 29th–31st July, 1937**: Proceedings of the technical session. *E. Afr. agric. J.* 13 (2), 1947 (67–87).

A fairly full report of the proceedings, including prepared notes and summaries of discussions on the following agenda: (1) The need for ecological, soil, land-utilization and social surveys on an interterritorial basis. (2) Biological and physical conditions in tropical and subtropical soils:—(*a*) the organic-matter cycle and soil fertility; (*b*) soil structure in relation to moisture, etc., and plant growth; (*c*) influence of forests on soil moisture, streamflow and run-off. (3) The fundamental basis of mixed farming. (4) Plant food status with special reference to the action of inorganic and organic fertilizers. (5) Mechanized farming, (6) East African Agricultural and Forestry Journal. (7) A Flora of East Africa.

The report of the study group on item 2 (*c*) emphasized the urgent importance of research on the hydrological results of the following lines of forest management and policy. (i) Reservation of hills and the drier mountain ranges with a view to their natural reforestation in order to preserve streamflow and regulate run-off. (ii) The conservation under forest growth of catchments, springs, and river banks to regulate flow. (iii) The replacement of natural forest by well managed plantations of indigenous and exotic species, mainly Cypress. The production of large quantities of softwood timber by this method is of the greatest potential value to East Africa, but the view has been expressed that it may have adverse effects on climate and stream flow. Research of this nature is eminently suited to co-operative action, as it is not purely a forest problem, but one affecting many other aspects of land use. If, for instance, it should be proved that the objects envisaged in (i) and (ii) are not in fact obtained, and that the programme in (iii) is deleterious to climate and water supply, forest policy must be largely recast. The most important problem, so far as forestry is concerned, is to gain some information on the effect of replacing natural forest by exotic plantations. It is recommended, as an immediate short-term policy, that the two following projects be put into effect at the earliest possible moment: (*a*) soil-moisture recording by the Bouyoucos block type of technique evolved at the Scott Agricultural Laboratories, Nairobi; (*b*) plant transpiration measurement by the torsion transpiration balance as developed by Henrici in South Africa. From the former project it would be possible to observe the rate of penetration of rainfall in forest cover and the rate of drying during drought. From the latter it should be possible to check whether transpiration is more or less rapid during the rainy period.

[2057]. 11.6 (729.5) : 91.3 : 96.1. WADSWORTH, F. H. **The influence of forest upon climate and water behaviour.** *Carib. For.* 8 (4), 1947 (289–99). [E.Span.f.]

The author summarizes the present state of knowledge on the effect of large areas of forest on climate and water régime, and explains the need in Puerto Rico for a sufficient forested area to protect the catchment areas which supply indispensable water for domestic use, irrigation, and hydro-electric installations. He proposes two principal measures to this end: (1) Government subsidies to the Coffee industry, in order to preserve the forests of shade trees in the mountain Coffee plantations, and (2) the reservation of forests on erodible areas as State forests.

[2058]. 11.6 : 11.48 : 11.34 : 11.2 : 12.19.2–3. [WILM, H. G.] **Factors associated with**

watershed conditions. Rocky Mt. Forest and Range Experiment Station [1947] pp. 5.

Discusses the factors of soils and their origin, topography and exposure, climate, and vegetation, and attempts to classify forest lands according to their erosion hazards, on a basis of these factors, taking the Pike National Forest as an example.

[2059]. 11.62 (678). GLOVER, J. [**Methods of measuring the penetration of rain and the movement of soil moisture under various vegetation types and on different slopes and soils at Shume, Tanganyika.**] *Rep. E. Afric. agric. Res. Sta. 1946*, 1947 (15–16). *Colonial* No. 213.

In the course of this study it was established that rain penetrated Shume valley soils on a 15–20° slope at the same rate for grass as for undisturbed tilth; but if the tilth of cultivated land was compressed, even by merely walking over it once, then the penetration rate was greatly reduced and run-off increased. Cultivated soils which could absorb up to 2 in. of rain per hour without run-off, were found to erode rapidly under much less heavy rain, when compressed by walking. Isolated trees or groups of trees in this region also play an important part in the erosion of the valley slopes. In driving rain they catch much water, which is deposited on the ground immediately below them, thus reinforcing the rain reaching the ground directly. When the rain is heavy, this local concentration is not easily absorbed, and run-off and erosion occur. The erosion is most marked on sloping lands which are cultivated up to and around the bases of the trees, but it is also severe on heavily grazed grass slopes. These two effects seem to offer a partial explanation of the soil erosion in the forest slopes beyond Shume, where squatters have made clearings, and cattle tracks traverse the forest.

The diurnal variations in flow of a forest stream were also measured. In dry weather the flow was reduced during the day but recovered at night. Possible evaporation from its surface could not account for the large diurnal variations, and these are thought to be, in some part, due to the transpiration of the surrounding vegetation which intercepts the normal steady percolation of subsoil water.

[2060]. 11.62 : 12.25 : 12.29. WIMBUSH, S. H. **Rainfall interception by Cypress and Bamboo.** *E. Afr. agric. J.* 13 (2), 1947 (123–5).

In May, 1946, an experiment was laid out in the Kikuyu Escarpment forest, Kenya, to compare the amounts of rainfall intercepted by the crowns of (*a*) Cypress (*Cupressus macrocarpa*) trees and (*b*) Bamboos (*Arundinaria alpina*). The methods employed for comparing the rainfall in the open with the amount penetrating to the ground through the canopy are described. During the first 6 months of the experiment, 17·2 per cent. of the total rainfall was intercepted by the crowns of the Cypress trees, as compared with 13·4 per cent. by the foliage of the Bamboos. The amount of rain which penetrated the crowns in the form of stem run-off was small, being 3·1 per cent. of the total rainfall in the Cypress plantation and 2·5 per cent. in the Bamboo forest.

[2061]. 11.62.1 (665) : 12.19.4 : 11.47.2. KILLIAN, C., and SCHNELL, R. Contribution à l'étude des formations végétales et des sols humifères correspondants des massifs du Benna et du Fouta-Djallon. [**Vegetation types and the corresponding humiferous soils of the Benna and Fouta-Djallon mountain ranges in French Guinea.**], *Rev. Canad. Biol.* 6 (3), 1947 (379–429 + plates). [F.f.e.] L.S.

Soil degradation following destruction of the forest was investigated in French Guinea, where this process is much enhanced by the heavy winter rains which cause intense leaching of the surface layers. Comparison was made of humic contents of the soils of relic forests, of the more or less degraded jungle and savanna, and of the thin layer of earth covering here and there the sterile crust of the *boval* [cf. *For. Abstr.* 9 (No. 1441)]. Forty-one soil samples were taken, and the surrounding plant formations noted. A parallelism was noticed between floristic regression and dehumification of the soil. Evidence is cited against the opinion that dehumification increases progressively with altitude. Humification is shown to be a function of forest cover and dehumification a function of forest clearing. Leaching of the soil is the most potent cause of dehumification, its intensity varying with soil permeability. The authors point out the ecological rôle of *Eriospora pilosa*, which clings to the rocks, favouring the formation beneath its dead leaves of a layer of very black earth on which other species can establish themselves. *From authors' summary.*

[2062]. 11.62.11 : 91.1 : 97.1. PFEIFFER, E. **The earth's face: landscape and its relation to the health of the soil.** Faber and Faber, Ltd., 24 Russell Square, London. 1947. pp. 138. Price 12*s*. 6*d*.

The author describes his purpose as 'to picture the conditions in our environment which lead to the maintenance or loss of the fertility of the earth's surface . . . and to direct the reader's attention to the surrounding landscape . . . in order to create a suitable environment for human beings everywhere'.

[2063]. 11.62.11 (410) : 23.3 : 12.25. GUNSTON, J. **Prevention of coastal erosion by planting conifers.** *Trees, Abbotsbury* 40 (2), 1947 (49–53). X.

An account of the fixation of the sand dunes at Holkham, Norfolk, which was undertaken by the second Earl of Leicester in 1885, planting being completed in 1890. About 300 acres were planted with Corsican, Austrian, Scots and Maritime Pine. All except the Maritime Pine were raised from seed in the Holkham nurseries. They were moved each year and planted out at 2 to 4 years old on the dunes, which were first cleared of marram grass. Planting of the whole area was undertaken after preliminary experiments in the most favourable sites. Austrian Pine was found most suitable for exposed sites. With the wide spacing employed, both it and Corsican Pine have regenerated naturally. A variety of plants including Sycamore, Birch, Willow, Elder, Holly, Wild Rose, Ilex and Privet have also established themselves. New dunes formed on the north side of the original dunes with the aid of faggots are being held by the marram grass.

[2064]. 11.62.11 (642 : 46) : 21.0 : 12.26–8 : 23.3. CANO SÁINZ-TRÁPAGA, B. Las dunas de Taxdir—el *Eucalyptus gomphocephala* D.C. **[The Taxdir sand dunes—*Eucalyptus gomphocephala* D.C.]** *Montes, Madrid* 3 (17), 1947 (430–3). [Span.]

Eucalyptus gomphocephala is the only *Eucalyptus* species to give good results in the fixation of the Taxdir sand dunes in Spanish Morocco. The tree is extremely wind-resistant and ideally suited to the climate and soil conditions found on the southern and eastern coasts of Spain.

[2065]. 11.62.11 (545) : 23.3 : 11.62.31 : 94.4. GORRIE, R. M. **Farm forestry in the Punjab.** *Indian For.* 73 (10), 1947 (435–7). (7th All-India Silvicultural Conference, Dehra Dun, 1946.)

An account of the organization of afforestation schemes by the soil conservation circle, often through village co-operative societies [cf. *For. Abstr.*, 8 (Nos. 814, 2209), with a description of the methods used for afforesting sand dunes formed by torrents [cf. *For. Abstr.* 8 (No. 1056)]. The technique is as follows:—Starting where the torrent has left wide bays of sand, a series of live hedges of brushwood and stakes are buried in trenches set at an angle of 25–30° to the current. The material used is any which will root in damp sand (e.g. *Vitex negundo, Arundo donax*, some local Willows, *Lannea grandis, Ipomoea*, several Figs, and to a less extent *Dalbergia sissoo*). These, preferably in mixture, are heeled into the trench up to the middle, with long lengths of twig sticking up to form a fine-tooth comb to delay the silt-laden flood. Where the current is particularly strong this type of live hedge is reinforced by stakes and brushwood walls. Exclusion of grazing is immediately followed by the growth of a mat of *Saccharum spontaneum* and this is supplemented by planting clumps of *S. munja* with a *Dalbergia sissoo* stump in the lee of each clump. Where the sand contains good silt, the Sissoo starts height growth at once and in 4 years will have caught up and suppressed the *S. munja*; but where the bed is pure sand and the water-table level drops to more than 6–8 ft. in the dry periods, the Sissoo may die back year after year and have to be replaced by *Acacia catechu, Prosopis juliflora, A. modesta* or *A. arabica*. In general, however, it does well and will give a harvest of fuel from thinnings in 6–8 years, small sawlogs and crooked poles in 20 years, and good sawlogs in 30 years. The *Saccharum* spp. and, later, other fodder grasses, and in some cases *bhabar* grass for papermaking, all give interim cash returns.

Experimental plots for afforestation of land on the desert fringe indicate the following essential points for reclamation in this area:—complete closure; contour soil working before sowing in lines at 6 × 6-in. spacing; the sowing early, plentifully, and in lines, not broadcast, of *Saccharum munja, Prosopis juliflora* and *Acacia arabica*; working of soil

between lines after each shower, without disturbing the plants; keeping down the weeds without disturbing the local vegetation which appears between the lines; thinning out the lines when necessary.

[2066]. 11.62.11 (54). GORRIE, R. M. **Contouring in principle and practice.** *Indian For.* 73 (9), 1947 (391–8). [7th All-India Silvicultural Conference, Dehra Dun, 1946.]

[2067]. 11.62.11 (786) : 43.3. FRIEDRICH, C. A. **Seeding grass by airplane on Western Montana's burned-over timberlands.** *Res. Note Nth. Rocky Mt. For. Range Exp. Sta.* No. 52, 1947. pp. 5 + plates.

Describes trials of sowing grass from aeroplanes on burned-over forest areas. It was demonstrated that sowing could be done successfully and economically under certain conditions, and the principal site factors influencing success have been determined. Grass is very effective in preventing excessive run-off and consequent erosion. Although sowing of grass has in some cases greatly retarded tree reproduction, it also retards the invasion of the site by weeds, poor grasses, and shrubs, which also menace tree reproduction. Sowing grass does not prevent reproduction of Lodgepole and Ponderosa Pine, which grow up together with the grasses, apparently without conflict. [Cf. *For. Abstr.* 9 (No. 2614).]

12. FOREST BOTANY. TREE SPECIES

12.1. *General Botany*

12.11. Physiology. Reproduction. Growth

12.11.1 *Metabolism. Plant Constituents. Growth Substances*

See also *For. Abstr.* 9 (Nos. 2045, 2050, 2190, 2478, 2483–4, 2494).

[2068]. 12.11.11 : 07.2 : 01.4. TIKHOV, G. A. Spektral'nyĭ analiz rasteni. [**Spectral analysis of plants.**] *Dokl. Akad. Nauk S.S.S.R.* (*n.s.*) 57 (7), 1947 (673–6). [Russ.] D.S.I.R.

Preliminary studies have been made of the spectral reflectivity of a number of plants, and provisional data are tabulated, including figures for the coefficient of brightness (K), at various wave-lengths, of the foliage of *Picea tianshanica*, *Malus domestica*, *Juniperus* sp. and *Pinus* sp.

[2069]. 12.11.11 : 34.26 : 12.11.16. BONNER, J., and GALSTON, A. W. **The physiology and biochemistry of rubber formation in plants.** *Bot. Rev.* 13 (10), 1947 (543–96).

[2070]. 12.11.15 : 12.21. POMERLEAU, R., and LECHAVALIER, H. Étude de l'effet antibiotique d'une bactérie sur le developpement du *Ceratostomella ulmi* (Schwarz) Buisman. [**Study of the antibiotic effect of a bacterium on the development of *Ceratostomella ulmi*.**] *Rev. Canad. Biol.* 6 (3), 1947 (478–84). [F.f.e.] L.S.

A case of striking antagonism between a bacterium of unknown origin and the causal organism of the Dutch Elm disease was observed in a culture in 1946. The bacterium has not yet been identified, but a description of its morphological and cultural characteristics is given. The antibiotic action is due to a diffusible thermostabie, non-filtrable substance produced by the bacterium. Spores of *Ceratostomella ulmi* submitted to the action of the antibiotic substance were appreciably modified and seemed to have lost viability in some cases. *From authors' summary.*

[2071]. 12.11.15 : 12.21. SZKOLNIK, M. **Antagonistic activity of a species of *Actinomyces* against *Ceratostomella ulmi in vitro*.** *Phytopathology* 38 (1), 1948 (85–6).

[2072]. 12.11.15 : 12.25 : 12.26–8 : 12.11.11. HAYES, L. E. **Survey of higher plants for presence of anti-bacterial substances.** *Bot. Gaz.* 108 (3), 1947 (408–14). O.B.D.

Among a number of plants tested, *Ilex decidua* and *Taxus canadensis* were found to contain antibacterial substances, which, in aqueous solutions, inhibited the growth of *Staphylococcus aureus*, *Escherichia coli* and *Erwinia carotovora*.

12.11.2. *Reproduction. Propagation*

See also *For. Abstr.* 9 (Nos. 2101, 2517).

[2073]. 12.11.2 : 23.26 : 11.15. STOUTEMYER, V. T., and CLOSE, A. W. **Rooting cuttings and germinating seeds under fluorescent and cold cathode lighting.**

Abstr. in *Amer. Nurserym.* 87 (1), 1948 (18, 20, 21, 50–1).

Cuttings of various Hollies, *Thuja* spp., *Taxus* spp. and other woody plants rooted well in these experiments with fluorescent lighting in semi-subterranean frames. Continuous lighting was used in most of the experiments and gave good results, though in some instances 16 hours daily was preferable. White, 3500-degree light was found to be more effective than blue in rooting cuttings, which explains the superiority of these lamps to the so-called 'daylight' lamps, which contain more of the blue end of the spectrum. Rooting of cuttings was particularly good with cold cathode lighting, but it requires extremely high voltages and great care is necessary in its use.

[2074]. 12.11.21 : 12.25. JOHNSON, A. G. **Sexual maturity in two White Pine species.** *J. For.* 45 (11), 1947 (826).

Information on two species (*Pinus peuce* and *P. armandi*) not dealt with by Righter in his summary of the age of first flowering in Pines at the Eddy Arboretum [cf. *For. Abstr.* 1 (245)]. Three specimens of *P. peuce* in Wisconsin produced in 1947 a few ovulate flowers at about 15 years of age; they are 3·5–4·5 ft. in height and made an average height growth of 6·5 in. last growing season. In a small group of *P. armandi* at Morton Arboretum, Lisle, Ill., a single individual was found to have a solitary ovulate strobilus in the spring of 1947, in its 9th growing season.

[2075]. 12.11.21 : 13.2. MCATEE, W. L. **Distribution of seed by birds.** *Amer. Midl. Nat.* 38 (1), 1947 (214–23).

A brief general account appended to a bibliography of 94 references.

[2076]. 12.11.22 : 12.25. SSORIN, V. A. Vegetativnoe razmnozhenie sibirskoy pikhtÿ. **[Vegetative reproduction in Siberian Fir.]** *Sovetsk. Bot.* 15 (4), 1947 (219–24). [Russ.] [Gosudarstvennÿ Institut Proektirovaniya Lesnogo Transporta, Leningrad.] D.S.I.R.

Literature on the vegetative reproduction of *Abies sibirica* by layering is reviewed. Tkachenko has reported that in the W. Urals 46 per cent. of natural regeneration of this species originated in this manner. From his own observations on *A. sibirica* in the Spruce/Fir forests of the upper Kama region, the author confirms the prevalence of layering from procumbent branches in this species, which is a pronounced shade-bearer with a living crown that often persists almost to ground level. Diagrams are included to illustrate this phenomenon in a 75-year-old tree. Such layers become independent plants by the rotting of the branch from which they originate.

[2077]. 12.11.22 : 12.26–8. CHANDRARATNA, M. F. **Studies on the vegetative propagation of Cinchona. I. The effects of temperature, cutting length and presence of buds and leaves on root formation.** *Trop. Agriculturist, Ceylon* 102 (3), 1946 (155–8). L.S.

[2078]. 12.11.22 : 23.26. SWARTLEY, J. C. **Fly ash as propagating medium.** *Amer. Nurserym.* 86 (12), 1947 (10–12).

'Fly ash' or 'flue ash' is collected mechanically from the flues and smokestacks of large heating or power plants that are equipped with powerful blowers. Having about the same particle size as a medium grade of sand, it is light in weight when dry, and as used by the author as a propagating medium for cuttings was half carbon and half silicon, with traces of aluminium, magnesium and calcium. It is lighter and easier to handle than sand, and compares favourably with peat in air- and water-holding capacity; at the same time, it remains more sterile than sand or sand and peat mixtures. Most of the conifers usually propagated by cuttings rooted satisfactorily and in in good percentages. Good results were obtained with synthetic growth substances and it is suggested that these may be used with fly ash more safely than with some other media. It is recommended that fly ash should be analysed before use, or else tested in a small plot.

[2079]. 12.11.22 : 12.26–8 : 24.51. HEUER, J. H., and LOOMIS, H. F. **Use of lanolin and other unguents for improving budding in Hevea rubber trees.** *J. agric. Res.* 75 (7/8), 1947 (207–13). O.R.E.

In experiments at the U.S. Plant Introduction Garden, Coconut Grove, Fla., it was found that pruning wounds healed more rapidly when treated with a 1 : 1 lanolin/beeswax mixture than with any other dressing. Buds from either fresh budwood or from that stored for periods up to 20 days, survived in greater

numbers when the bud-patch and the surrounding area of cambium on the stock were treated with a 3 : 1 lanolin/beeswax mixture on unwrapping than when no treatment was given. Treatment at the time of budding, or both at the time of budding and unwrapping, was not usually so successful as treatment at the time of unwrapping only. If a lanolin/beeswax mixture is applied on unwrapping, the usual waiting period of 10–14 days between opening the buds and cutting back the stock can be eliminated and the stock can be cut back immediately, the cut surface being treated with a 1 : 1 lanolin/beeswax mixture. Buds treated with 3 : 1 lanolin/beeswax mixture were found to shoot more slowly than untreated ones after the stock was cut back. *From authors' summary.*

12.11.3. *Heredity. Breeding. Hybridization. Races and Questions of Provenance. Cytology*

See also *For. Abstr.* 9
(Nos. 2121–3, 2143, 2477, 2558, 2560).

[2080]. 12.11.3. PAVARI, A. Horizontes de la genética forestal. **[Developments in forest tree-breeding. [A general summary.]]** *Montes, Madrid* 3 (18), 1947 (517–23). [Span.]

[2081]. 12.11.3 : 12.11.22 : 23.26. LARSEN, C. S. **Estimation of the genotype in forest trees.** *Aarsskr. Vet.-Landbohøjsk.* 1947 (87–128). [E.]

A semi-popular review of experiments carried out during the past 20 years, in the grafting of twigs of Beech, Ash, Birch, Larch, Spruce, and Douglas Fir from good phenotypes, in order to discover whether they represent equally good genotypes. The article is illustrated by numerous photographs of the original trees and the grafts at about 10 years of age. So far, the characters considered have been form and rate of growth, but similar experiments are planned in regard to such characters as resistance to disease or low temperatures.

[2082]. 12.11.3 : 12.25. RIGHTER, F. I. **New perspectives in forest tree breeding.** *Science* 104 (2688), 1946 (1–3). O.R.S.

The application of agricultural plant-breeding concepts to silviculture has led in the past to misconceptions. For example, the high degree of genetic uniformity required for agricultural crops is not necessary in silviculture. Interplanting to test growth rates of hybrid stock, will produce stands of merchantable timber whatever the outcome of the experiment. Either a pure stand will be obtained through the dominance of one kind of stock, or, where growth rates are equal, a mixed stand will result. In either case no commercial loss need be sustained. The author believes that the generally accepted idea, that it is impracticable to produce tree hybrids on a large scale through controlled pollination, is based largely on experiments with angiosperms. Tests conducted at the Institute of Forest Genetics, Placerville, California, have indicated that numerous interspecific coniferous hybrids can be produced in large quantities and at a reasonable cost through controlled pollination. The essentials of the breeding procedure are as follows:— Two species are crossed on a small scale. If hybrids are obtained they are tested for vigour and form against the parental species in small nursery tests for 2 or 3 years. If the results are promising, the hybrids are produced in quantity and interplanted with the common stock in the area to be reforested. The question of the succeeding crop can be examined in advance by investigating seed production and the ability of the F_2 generation to establish itself, and by testing the vigour of the F_2 generation in small nursery and plantation experiments. If results are favourable, restocking of the area is left to the F_2 population, which is subjected to natural and also (if possible) to artificial selection. If results are unfavourable the area is re-planted with the F_1 hybrid, or, perhaps, with a back-cross of one of the parental species and the hybrid.

[2083]. 12.11.3 : 12.25 : 56. MUNGER, T. T. **Growth of ten regional races of Ponderosa Pine in six plantations.** *For. Res. Notes Pacif. Nthwest. For. Exp. Sta.* No. 39, 1947. pp. 4.

In 1926, seed from 10 regional races of Ponderosa Pine was sown at the Wind River Nursery, and two years later plantations from this stock were established on six contrasting sites. Growth has been recorded for 20 years. The results show a far greater variation (10 times as great) in increment between sites than between races.

[2084]. 12.11.3 : 12.26–8 (7). PALMER, E. J. **Hybrid Oaks of North America.** *J. Arnold Arbor.* 29 (1), 1948 (1–48).

The author's aim is to review the subject and bring together the information already available, in a convenient form for study. Many questions of identity, variability and behaviour of different hybrids will not be cleared up until they are approached experimentally and with the aid of cytological study. Full bibliographies are given for some 80 hybrids.

[2085]. 12 11.3 : 12.26–8 : 23.23.1. CUMMINGS, W. H. **Progeny test with Black Locust seed from mother trees of varied age and height growth.** *J. For.* 45 (11), 1947 (793–8).

In the fall of 1938, seed was collected from 27 Black Locust [*Robinia pseudoacacia*] trees in as many different stands of volunteer growth in southern Ohio. Seed ranging from 20,000 to 46,000 per lb., was sown in nursery beds to produce one-year seedlings, which were planted out in the spring of 1940. In the spring of 1946, height of Black Locust of 27 seed sources averaged 8 ft. in 3 plantings. Growth rate of the mother tree showed a significant effect on the development of progeny that was not apparent in the characteristics of seed or 1-year seedlings. The 6-year-old plantings averaged 9·1 ft. in height for progeny of trees of good growth, compared with 7·0 and 7·7 ft. respectively for progeny of trees of fair and poor growth. In one case, progeny of a young, fast-growing tree was 11 ft. taller than progeny of a medium-aged, slow-growing tree. Seed that was heavy, light-coloured and plump, produced superior seedlings. Results of this study indicate that large seed of this character and of satisfactory viability should be collected from fast-growing young trees in the immediate locality, for the nursery production of Black Locust seedlings for fence-post production. *From author's summary.*

[2086]. 12.11.3 : 12.26–8 : 56 (76). SILEN, R. R. **Comparative growth of hybrid Poplars and native northern Black Cottonwoods.** *For. Res. Notes Pacif. Nthwest. For. Exp. Sta.* No. 35, 1947. pp. 3.

Comparative plantings of fast-growing hybrid Poplars developed by the Oxford Paper Co. in New England, and the local Black Cottonwood [*Populus trichocarpa*], have been studied at Lady Island, Washington. The Black Cottonwoods, which are generally trees of good form, show up well in the comparison. Eight-year-old trees are as large in diameter, and 9-year-olds are of greater volume than the average hybrid, while the tallest 9-year-old is 59 ft. high, which suggests that native strains may grow as fast as the best of the hybrids tested.

[2087]. 12.11.3 : 12.26–8. ATCHISON, E. **Studies in the Leguminosae. I. Chromosome numbers in *Erythrina* L.** *Amer. J. Bot.* 34 (8), 1947 (407–14). O.B.D.

Chromosome counts for 33 among the 105 species of *Erythrina* reveal only two variants from $2n = 42$; these were *E. amazonica* and *E. acanthocarpa* with $2n = 84$. From these counts a basic number of $x = 21$ is derived for the genus. $x = 21$ is not encountered elsewhere among the Phaseoleae. Its origin is best explained through amphidiploidy, hybridization of $x = 10$ and $x = 11$ types with subsequent doubling of the hybrid chromosome complement.

If comparisons are restricted to as small a unit as the species group, the tetraploid *E. acanthocarpa* ($2n = 84$) shows an increase in curare-like effect with increase in chromosome number. Diploid species in other species groups, however, have higher reaction values.

12.14. Organography. Morphology. Anatomy. Histology

[2088]. 12.14 : 12.26–8 : 12.19. LANGDON, L. M. **The comparative morphology of the Fagaceae. I. The genus *Nothofagus*.** *Bot. Gaz.* 108 (3), 1947 (350–71). O.B.D.

[2089]. 12.14.4 : 12.26–8 : 12.14.5. MÜLLER, D. Bøgens Dværggrene. [**The short shoots of Beech.**] *Dansk Skovforen. Tidsskr.* 32 (11), 1947 (363–5). [Dan.]

A short shoot is defined as one having an annual growth in length of 0·5 cm. or less. Long and short shoots may be developed alternately along a single shoot axis, probably as a consequence of variations in light. The short shoots do not branch. Though it would be extremely difficult to determine the quantity of short shoots on a tree it is comparatively simple to determine the quantity of foliage on the two shoot types. This was done for a number of trees of different ages, and the results are tabulated. In percentage

(by fresh weight) of the total quantity of foliage, that of the short shoots was 92 for an 83-year-old tree, about 80 for two 46-year-old trees and about 55 for three 24-year-old trees. As the leaves of long shoots are more or less pronounced sun-leaves, their percentage by area would be even lower than that by weight.

[2090]. 12.14.5 : 12.25. SHIRLING, A. E. **The age of needle leaves.** *Trans. Kansas Acad. Sci. 1946–7*, 49 (2), 1946 (161–6). E.B.

Seven species were studied in Colorado and compared with reference to the persistence of their needles. The extent of needle-age variation was determined for different part of the same tree, for different trees of the same species, and for different species. Sections were cut though branches and upper parts of the boles of trees at points where the lowest, oldest needles were still attached and green, and the ages of these sections determined by counting growth rings. In choosing specimens for study, some attempt was made to cut branches which had the greatest proportion of their length covered with needles, but this was very uncertain, for length of area covered with needles, and size of branch or tree, bore little relation to age of needles. The following table summarizes the results of the study:—

Species	*Extremes in persistence of needles (in years)*	
	Longest	*Shortest*
Pinus ponderosa var. *scopulorum*	10	4
P. contorta var. *murrayana*	16	4
P. flexilis	14	4
Picea engelmanni	32	4
P. pungens	23	7
Pseudotsuga mucronata	15	4
Abies lasiocarpa	28	6

12.19. Geographical Distribution. Plant Geography and Sociology

[2091]. 12.19. GOOD, R. **The geography of the flowering plants.** Longmans, Green and Co., London. 1947. pp. 403 + plates + maps. [University College, Hull.]

In the author's words 'The first part consists of a purely descriptive account of the facts of distribution in one great group of plants, and the second consists of a theoretical consideration of these facts and concludes with an attempt to give a generalized explanation of them.' General introductory chapters are followed, in chapters 4 to 11, by an account of the distribution of families, genera and species, and the rest of Part I with the history and distribution of the British flora, the distribution of plants in an English county, and the geological history and past distribution of the flowering plants. In Part II six chapters deal with the factors of distribution, and the last two with the theory of tolerance and conclusions. The text includes 71 line drawings and there are indexes of plant names, persons and places, and a bibliography of 295 references.

[2092]. 12.19. GUINOCHET. Phytosociologie et sylviculture. [**Phytosociology and forestry.**] *Bull. Soc. for. Franche-Comté* 25 (4), 1947 (149–58). [F.]

[2093]. 12.19 : 11.15 (213) : 01.3 : 11.3 : 61.4. BOYKO, H. **On forest types of the semi-arid areas at lower latitudes.** *Repr.* from *Palest. J. Bot. (R.Ser.)* 5 (1), 1945 (1–21). [E.]

An historical review is presented of the hitherto accepted forest types and of the conception on which their respective systems of classification were based: on the one hand the 'site types' created by Cajander solely on the basis of surface vegetation, and on the other, the 'cover types' that take account only of the tree stand, as used largely in the U.S.A., Russia, and the humid tropics. A combination of the two is being employed in Central Europe and is gradually gaining ground elsewhere.

All the accepted principles of forest-type classification have been evolved in countries with humid climates and completely fail to meet the conditions in semi-arid areas at lower

latitudes. An attempt is made in this paper to indicate a principle suitable for the classification of forest types in such areas.

The most important criterion underlying the definition of forest types is found in regeneration. Now regeneration, in the regions bordering on the equatorial forest belts, is decisively affected by solar radiation or insolation. Within a given set of macroclimatical conditions, insolation, in its turn, is primarily dependent on the angle of slope and aspect, and insolation totals may be expressed in the form of tables or graphs. Evidence exists to show that, in Palestine, as in other countries with a similar, semi-arid, sunny climate, comparatively small changes of the angle of inclination on a given aspect may in themselves suffice to induce surprisingly wide differences of vegetation, so that characteristics of distinct phytogeographical regions are discernible within an area of only a few square metres. The insolation value of a site is adequately defined by indication of the inclination and direction of exposure. This value, designated the IE-factor, has been introduced as a criterion for the classification of forest types, owing to the decisive rôle it plays in regeneration. To illustrate the marked extent to which units of vegetation may serve as indicators in respect of the IE-factor, a plant association is cited in the mountains of northern Palestine, the ecological amplitude of which is represented in a diagram. A forest type defined according to this conception would appear to offer a practical basis for silviculture in the immense devastated areas of the semi-arid regions at lower latitudes.

[2094]. 12.19 : 11.15 : 11.2 : 11.33. BOYKO, H. **On the role of plants as quantitative climate indicators and the geo-ecological law of distribution.** *J. Ecol.* 35 (1/2), 1947 (138–57).

The correlations between general geographical distribution and specific topographical distribution of plants are discussed and formulated as the 'geo-ecological law of distribution'. The decisive rôle of insolation (expressed by the angle of insolation) and direction of exposure (the '*IE*-factor') on the vegetative cover in semi-arid and arid regions at lower latitudes, is explained by detailed analysis of plant-sociological records in the wilderness of Judaea. *From author's extract.*

[2095]. 12.19 : 11.15 : 12.26–8 (569) : 21 : 11.33. BOYKO, H. **The decisive role of direct sun-radiation in the distribution of *Quercus aegilops* L. in Palestine.** *Repr.* from *Palest. J. Bot.* (*R.Ser.*) 6 (1), 1947 (20–2). [E.]

[2096]. 12.19 : 12.29. PENFOUND, W. T., and DEILER, F. G. **On the ecology of Spanish Moss [*Dendropogon usneoides*].** *Ecology* 28 (4), 1947 (455–8).

12.19.1. *Regional Floras, including Check Lists*

[2097]. 12.19.1 (675) : 12.26–8. ROBYNS, W. La flore des Spermatophytes du Parc National Albert: Vol. II, Sympétales. **[The spermatophytic flora of the Parc National Albert [Belgian Congo]: Vol. II. Sympetalae.]** Inst. Parcs nationaux du Congo belge, Bruxelles. 1947. pp. 628. [F.] Price 750 frs. belg. (88*s.*).

[2098]. 12.19.1 (74) : 12.25–8. HARLOW, W. M. **Fruit key to northeastern trees.** Published by the Author. 1946. pp. 50 + plate. [New York State College of Forestry, Syracuse.]

[2099]. 12.19.1 (86) : 12.26–8. LITTLE, E. L. **Does Mahogany (*Swietenia*) occur in Ecuador?** *Trop. Woods* No. 92, 1947 (41–3).

The author reviews the reports of alleged occurrence of *Swietenia mahagoni* in Ecuador and concludes that they refer not to this species but to *Platymiscium pinnatum*, which is known by the common name 'Caoba', the usual Spanish equivalent of 'Mahogany'.

[2100]. 12.19.1 (88) : 31.0 : 34.2 : 23.27 : 02.41. STAHEL, G. De nuttige planten van Surinam. **[The useful plants of Surinam.]** *Bull. Dep. Landbouwproefsta., Suriname* No. 59, 1944. pp. 239. [Du.]

An enlarged edition of Bulletin No. 57 [see *For. Abstr.* 5 (19)] with sections on: food crops (including fruits from forest trees); miscellaneous crops (including oil-bearing trees); basket material and thatch; timber; and ornamental plants (including flowering and shade trees). The various trees listed in the timber section are arranged alphabetically under the Dutch vernacular names, together with the scientific name and a brief description of the

properties, quality and use of the timber. Check lists give the trees alphabetically under their scientific names (classified by families) and the vernacular equivalents.

12.19.2-3. *Vegetation Types*

See also *For. Abstr.* 9 (No. 2622).

[2101]. 12.19.2–3 : 23.1 : 12.26–8. WATT, A. S. **Pattern and process in the plant community.** *J. Ecol.* 35 (1/2), 1947 (1–22).

The author comments on the failure of ecologists, so far, to apply dynamic principles to the elucidation of the plant community itself and to formulate laws according to which it regenerates and maintains itself. A statement of the nature of the relations between the components of the community is here attempted in greater or less detail for 7 communities (the regeneration complex, dwarf *Callunetum*, eroded *Rhacomitrietum*, bracken, grassland A, grass-heath on acid sands, and Beechwood). The ultimate parts of the community are the individual plants, but a description of it in terms of these units is impracticable. It is, however, feasible in terms of the aggregates of individuals and of species which form different kinds of patches. In the subsequent analysis evidence is adduced to show that the patches (or phases, as the author calls them) are dynamically related to one another, and out of this fact arises that orderly change which accounts for the persistence of the pattern in the plant community. There are also departures from this inherent tendency to orderliness caused by fortuitous obstacles to the normal time sequence. At any given time, therefore, structure is the resultant of causes that make for order and those that tend to upset it.

The patchiness in some all-aged Beechwoods on the Chilterns is interpretable in terms of the temporal sequence of phases (bare, *Oxalis*, *Rubus*) to which must be added a fourth, the gap phase, to which regeneration is confined because it is excluded from the others. Factors such as storms, fire, drought, and epidemics, create a gap phase of exceptional dimensions, and if the whole gap phase is regenerated about the same time (which is made likely by such factors as periodicity in seed years and meteorological factors for seed survival) there may be initiated an age class of abnormal area, which will persist through the age classes until at least the death of the trees and may even influence the structure of the next generation. In other words, the relative areas under the age classes may bear no relation to current meteorological factors, but be explicable in terms of some past event occurring possibly 200–300 years ago.

Another point dealt with is the normal inclusion in the cycle of change, of a phase or patch dominated by another species of tree, e.g. patches of Ash, Oak or Birch in different kinds of Beechwood. Such a phase (e.g. Birch) may occupy large or small areas, but irrespective of the area it occupies, if the relation is not seral but cyclic (that is, one of alternating equilibrium, in which successful regeneration of the Beech is inhibited by itself, but promoted by the conditions brought about by the other species of tree), then such a phase is part and parcel of the system. To recognize the Birchwood and Beechwood as separate entities, may be convenient in classification, but successful practical management of such woods depends on their recognition as integral parts of a co-ordinated whole.

The widespread occurrence of patchiness is of interest in itself, but the persistence of the patch in time under continuing normal conditions is fundamental. Speaking generally, plants can only establish themselves during the gap phase, formed by the death of the dominant in the mature phase, and cannot, owing to competition, spread into adjacent phases. Thus prevented from spreading laterally, the patch becomes a microcosm of limited area with continuous but restricted food supply, and a population which cannot spread, but can develop, and this development appears to follow a course in which total production per unit area is represented by a curve of the growth type. It would thus appear that certain phenomena of the plant community can be brought within the scope of mathematical inquiry.

[2102]. 12.19.2–3 (44) : 61.4. CHABROL, P., and REY, P. La cartographie botanique au service du reboisement. [**Botanical cartography in the service of afforestation.**] *Rev. Eaux For.* 85 (12), 1947 (743–60). [F.]

An account of the vegetation map on a scale of 1/200,000 which is being made by the French Centre national de la Recherche scientifique, taking the completed sheet of the Toulouse region as an example.

[2103]. 12.19.2–3 (648) : 09.7 : 11.45 : 34.27 : 02.41. GUINEA, E. Aspecto forestal del desierto. La vegetación leñosa y los pastos del Sáhara español. [**The desert from the point of view of forest cover. Woody vegetation and grazing species of the Spanish Sahara.**] Instituto Forestal de Investigaciones y Experiencias, Madrid. 1945. pp. 152 + plates + map.

A detailed description of the Spanish Sahara (Rio de Oro) from the geological and botanical point of view. The adaptation of woody species to desert conditions and the various plant associations found there are discussed. An account is given of the most important woody species and their uses and also of all types of vegetation suitable for grazing. A list of Arab names of species is included. The work is illustrated by plates and maps.

[2104]. 12.19.2–3 (673). AIRY SHAW, H. K. **The vegetation of Angola.** *J. Ecol.* 35 (1/2), 1947 (23–48).

A précis in English of a study by J. Gossweiler and F. A. Mendonça published in 1939 [see *For. Abstr.* 9 (No. 143)].

[2105]. 12.19.2–3 (81) : 09.7. DANSEREAU, P. **The distribution and structure of Brazilian forests.** *For. Chron.* 23 (4), 1947 (261–77 + plates).

Short account of the 7 principal vegetation types (Amazonian rain forest, coastal rain forest, Parana Pine forest, caatinga, cocäes, campos cerrados, pampa), and descriptions of the structure of a few typical stands.

12.19.2. *Forest Types*

See also *For. Abstr.* 9 (Nos. 2038, 2134, 2142, 2628).

[2106]. 12.19.2 (45) : 2. ERRICO, P. D'. Flora e boschi dell' altopiano di Asiago. [**Flora and forest of the Asiago plateau.**] *Ital. for. mont.* 2 (5), 1947 (219–38). [It.]

The author discusses the floristic conditions of the area occupied by forest or forest glades, lists the herbaceous, shrub and tree species, putting them into biological classes according to Raunkiaer's classification, and concludes that the vegetation found on these soils of high water-holding capacity is predominantly mesophilic in character. He then examines the various forest types (pure and mixed stands of *Pinus montana*; mixed coniferous stands both with and without Beech understorey; pure Beech coppice with scattered mature conifers and conifer regeneration; mixed Beech, Willow, and Hazel coppice with conifer regeneration), and suggests the silvicultural principles according to which they ought respectively to be treated.

[2107]. 12.19.2 (498) : 12.25. HARALAMB, A. Stațiuni de pin cembra în munții Făgărașului și Ezerul-Păpușa. [**Stands of *Pinus cembra* in the mountains of Făgăraș-ului and Ezerul-Păpușa in Transylvania.**] *An. Inst. Cerc. Exp. for., București 1944–45*, 10, 1946 (239–47). [Rum.f.] P.R.

Describes three stands of *Pinus cembra*, all of which occur at the upper limit of the forest, at altitudes of 1,900–2,100 m. on the sites of former glaciers.

[2108]. 12.19.2 (569) : 12.26–8. BOYKO, H. **A Laurel forest in Palestine (*Lauretum quercetosum infectoriae*).** *Repr.* from *Palest. J. Bot. (R. Ser.).* 6 (1), 1947 (1–13). [E.]

Contains ecological remarks on *Laurus nobilis*, showing the species to be a very sensitive climatic indicator which may be used as a quantitative indicator for humidity (precipitation); palaeo-historical remarks on *Laurus* in Palestine and the Mediterranean area generally; an analysis of the *Lauretum infectoriae* (*Laurus* forest with *Quercus infectoria* as a characteristic species); and a description of stages of degradation leading from, and succession stages leading towards the *Lauretum infectoriae* as a climax type. *From author's summary.*

[2109]. 12.19.2 (667). FOGGIE, A. **On the definition of forest types in the closed forest zone of the Gold Coast.** *Fm. & For.* 8 (2), 1947 (50–55).

The need to determine and define the forest types within the Closed Forest Zone is discussed; the extent of the zone is described; previous classifications are considered and criticized. Possible bases on which division and classification might be made are considered: (1) *Physiognomy of the vegetation*; variation within the zone is considered to be insufficiently distinct to permit subdivision on this basis. (2) *Physiographic regions*; though two such regions exist within the zone, the forest

vegetation has not been found to differ markedly between them. (3) *Geological formations*; changes in the underlying geological formations are not reflected by any large-scale alterations in the forest. (4) *Soil*; the soil/water relationship is effective in forming one clearly defined formation 'Tropical swamp/Marsh forest' but otherwise there does not appear to be any marked correlation between soil types and forest vegetation. (5) *Climate*; the correlation between annual rainfall and vegetation is poor, and other climatic factors are insufficiently known to be used. (6) *Floristic composition*; though the difficulties and possible dangers of identifying associations on their floristic composition are considerable, it is considered the surest foundation of classification. Notes are given on the methods by which the identification of associations and types is now being approached. *From author's summary.*

[2110]. 12.19.2 (669). KEAY, R. W. J. **Notes on the vegetation of Old Oyo forest reserve.** *Fm. & For.* 8 (1), 1947 (36–47 + plates).

[2111]. 12.19.2 (795) : 11.41.3 : 11.45.9 : 12.25. TARRANT, R. F. **First forest soil survey gives significant results.** *For. Res. Notes Pacif. Nthwest. For. Exp. Sta.* No. 36, 1947. pp. 3.

Summary of the findings of a forest soil survey on the Pringle Falls Experimental Forest. The most significant result is the discovery of an apparent relationship between soil drainage and timber type in this area. In general, poorly drained soils were found to support Lodgepole Pine stands but not Ponderosa Pine, while the well and excessively drained soils were occupied by Ponderosa Pine to the exclusion of Lodgepole Pine. It is concluded that the usual theory that the distribution of these two species is the result of fire, will have to be revised.

[2112]. 12.19.2 (87) : 09.7 : 11 : 13.15. BEEBE, W., and CRANE, J. **Ecology of Rancho Grande, a subtropical cloud forest in northern Venezuela.** *Zoologica, N.Y.* 32 (Pt. 1, Nos. 1/8), 1947 (43–59 + plates). G.U.

[2113]. 12.19.2 (969) : 12.19.4 : 45.11. EGLER, F. E. **Arid Southeast Oahu vegetation, Hawaii.** *Ecol. Monogr.* 17 (4), 1947 (383–435).

Specifically, this paper is a report on the composition, structure, and other features of the vegetation of arid south-eastern Oahu. In general, it is a contribution to the knowledge of arid tropical vegetation, especially as regards the roles of pantropical species, the effects of grazing and fire, and the interrelationship of forest scrub and grassland. Among the vegetation types discussed are the Mangrove forest, the *Casuarina* forest and the *Prosopis* forest. Several species of Mangrove were introduced on Molokai some years ago, the propagules of these were swept across the 100-km. channel to Oahu, and to-day *Rhizophora mangle* and *Bruguiera* spp. occur on all available sites and are spreading rapidly; the trees form a dense closed forest, already 10 m. high. *Casuarina equisetifolia* has been introduced and grows well on the rocky bluffs along the coast, but does not reproduce itself. *Prosopis chilensis* was introduced in 1838 and to-day forests of this species extend throughout the dry regions on all the islands. It is believed that the present dense, even-aged stands originated under conditions of intensive overgrazing on an essentially bare floor, under full light, from seeds excreted by animals and trampled into the ground during the wet season. The economic value of the *Prosopis* forest is very high; the trees supply firewood and fence posts, the flowers are the basis of a honey industry, and the pods are often the only available cattle feed in the dry season; the shade is used by cattle, and communities of forage plants develop beneath it. These forests are also significant in soil conservation by preventing erosion and increasing nitrogen content. The foliage is unpalatable to stock. In the absence of grazing, the *Prosopis* community will probably prove a one-generation type destined to be succeeded by *Schinus terebinthifolius*, *Erythrina sandwicensis*, and *Leucaena glauca*.

12.19.3. *Other Vegetation Types*

[2114]. 12.19.3 (669). KEAY, R. W. J., and ONOCHIE, C. F. **Some observations on the Sobo plains.** *Fm. & For.* 8 (2), 1947 (71–80).

The Sobo plains in Southern Benin are extensive grasslands, surrounded by high forest, and with occasional islands of forest in the midst of the grass. The authors of this article examined one of the 'islands', distinguished and described the types of vegetation

and drew up full lists of species. From these data a profile diagram was constructed. The various theories of the origin of these grasslands are discussed, and it is concluded that they are a special and extreme type of Derived Savanna, consequent on cultivation, lacking all the woody fire-tolerant species of true savanna and made up largely of herbaceous weed species. It seems clear that the grassland is maintained as such by fire.

12.19.4. *Succession*

See also *For. Abstr.* 9 (Nos. 2061, 2113).

[2115]. 12.19.4 (493) : 09.2. BOUDRU, M. L'indigénat de nos essences forestières en Ardenne. [**The indigenous forest species in the Ardennes.**] *Bull. Soc. for. Belg.* 53 (1/2), 1946 (27–33). [F.]

The succession of the principal species (Beech, Oak, Spruce, Pine and Fir) from boreal times to the present day, as revealed by pollen analyses. It is concluded that Oak and Beech are indigenous to the Ardennes, Pine was originally indigenous and has been re-introduced after disappearing for several centuries, Fir and Spruce are aliens, introduced comparatively late.

[2116]. 12.19.4 (81) : 12.26–8. DANSEREAU, P. Zonation et succession sur la restinga de Rio de Janeiro. I. Halosère. [**Zonation and succession on the restinga of Rio de Janeiro. I. The halosere.**] *Rev. canad. Biol.* 6 (3), 1947 (448–77). [F.f.e.] L.S.

Cf. *For. Abstr.* 8 (No. 1653).

12.2. *Special (Systematic) Botany*

12.21. Fungi

See also *For. Abstr.* 9 (No. 2003).

[2117]. 12.21. BOUDRU, M. À propos de la forme supérieure de *Brunchorstia destruens* Eriksson. [**The perfect stage of *Brunchorstia destruens*.**] *Bull. Soc. for. Belg.* 52 (12), 1945 (244–53). [F.]

The object of this note is to show that *Cenangium ferruginosum* (*C. abietis*) and *Crumenula pinicola* have no genetic connexion with *Brunchorstia destruens*, but that the perfect stage of the latter is *Crumenula abietina*. *From author's summary.* [Cf. *For. Abstr.* 8 (No. 2720); 9 (No. 2547).]

[2118]. SNYDER, W. C., and HANSEN, H. N. **Classification and identification in *Fusarium*.** *Abstr.* in *Phytopathology* 38 (1), 1948 (23–4).

Great variability between clones of wild types and between their derivatives, is common throughout the genus *Fusarium*. A classification is required that will put together into one species all such entities of that species, whether they represent clones existing in nature or derived in culture, in spite of any morphological, biological, or apparent differences resulting from mutation, environment, or host relationships. Such a system would recognize only a few species, based on morphology, would indicate pathogenicity by *forma* names and races within *formae* by numerals, and has been found in practice to facilitate identification. The criterion of spore size, much used in the past for speciation, is unreliable since the dimensions of spores in wild types of fungus vary widely. The practice of basing species on hosts is also inadequate, since it has been shown that various races are pathogenic on several different combinations of hosts.

12.25. Gymnosperms

[2119]. 12.25 (51). LAW, Y. W. **Gymnosperms of Eastern China.** *Bot. Bull. Acad. Sinica* 1 (2), 1947 (141–71).

[2120]. 12.25. BUCHHOLZ, J. T., and GREY, N. E. **A taxonomic revision of *Podocarpus*. I. The sections of the genus and their subdivisions with special reference to leaf anatomy. II. The American species of *Podocarpus* : section *Stachycarpus*.** *J. Arnold Arbor.* 29 (1), 1948 (49–76 + plates).

12.26-8. Dicotyledons

See also *For. Abstr.* 9 (No. 2241).

[2121]. 12.26–8 (85) : 12.14 : 12.11.3 : 12.19. SEIBERT, R. J. **A study of *Hevea* (with its economic aspects) in the republic of Peru.** *Ann. Mo. bot. Gdn.* 34 (3), 1947 (261–352 + map). O.B.D.

A comprehensive study of the genus *Hevea* in Peru, comprising:—morphology; pollination; intraspecific variations; a taxonomic study of the Peruvian spp. and putative hybrids, with a key to the principal spp. and varieties; distribution (with map), habitat and historical ecology.

[2122]. 12.26–8 (48). WEIMARCK, H. De nordiska ekarna. *2. Quercus petraea* och *Q. petraea* × *robur* jämte en systematisk och vaxtgeografisk överblick. [**The Scandinavian Oaks. 2. *Q. petraea* and *Q. petraea* × *robur*, with a review of their taxonomy and distribution.**] *Bot. Notiser, Lund* 1947 (2), (105–34 + 5 photos). [Sw.e.] [Lunds Botaniska Museum.] O.B.D.

See also *For. Abstr.* 9 (Nos. 168, 2147).

[2123]. 12.26–8 (481) : 12.14.5 : 12.11.3. GLØERSON, F. Bladform og bladstilklengde hos eikeartene i Vest-Agder. [**Leaf forms and length of leaf-stalks of the Vest-Agder Oak species.**] *Tidsskr. Skogbr.* 52 (1/2), 1944 (1–10). [Nor.]

[2124]. 12.26–8 (51). P'EI, C. **The Juglandaceae of eastern China.** *Bot. Bull. Acad. Sinica* 1 (3), 1947 (203–8).

[2125]. 12.26–8 (86). DUGAND, A. Observaciones taxonómicas sobre las *Lecythis* del norte de Colombia. [**Notes on the taxonomy of the *Lecythis* species of northern Colombia [with an account of a new species, *L. magdalenica*].**] *Caldasia* 4 (20), 1947 (411–26). [Span.] A.C.P.

[2126]. 12.26–8 (51) : 31.0. CHUN, W. Y. **A new genus in the Chinese flora.** *Sunyatsenia* 6 (3/4), 1946 (195–8). L.S.

An account of a new Chinese genus, *Zenia*, with one species, *Z. insignis*, which is found in Kwangtung. It is a large, rapid-growing tree with ornamental foliage and flowers, and yields a high-quality timber suitable for cabinet-making. The affinities of the new genus are closest to the tribe Cassieae of the Caesalpinioideae.

[2127]. 12.26–8. POSKIN, A. Les variétés et les types de peuplier du Canada. [**The varieties and types of 'Canadian' Poplar.**] *Bull. Soc. for. Belg.* 54 (11), 1947 (377–91 + plates). [F.]

An account of the principal characters and taxonomy of the Black Poplars, particularly the hybrids *serotina, regenerata, gelrica, brabantica, marilandica* and *robusta*, which are commonly known in Belgium by the indefinite term 'Canadian'.

[2128]. 12.26–8 (51). P'EI, C. **The *Ulmaceae* of Eastern China.** *Bot. Bull. Acad. Sinica* 1 (4), 1947 (283–97).

13. FOREST ZOOLOGY

13.1. *General Zoology*

[2129]. 13.15 : 13.2 : 13.19 : 45.3. VOÛTE, A. D. **Regulation of the density of the insect-populations in virgin-forests and cultivated woods.** *Arch. néerl. Zool.* 7 (3/4), 1946 (435–70). [E.]

The author expounds a theory of the way in which the density of population of forest insects is regulated in natural surroundings. Whereas abiotic factors, e.g. climate, always permit a general growth, i.e. a denser population, it is biotic factors that regulate this growth; first, the selective independent factors, principally the polyphagous predators and parasites, then the modifiable factors, especially monophagous parasites (which have multiplied with the increase of their host) and finally—if these fail to effect control (the 'escape' phase)—the general dependent factors will do so, a 'crisis' eventually resulting which reduces the high population density to a low level.

Mixed virgin forests have great resistance to insect pests, their population usually being maintained at the 'natural density' level. Transition from virgin forest to cultivated woods usually means impoverishment of the fauna, a decrease in the activity of selective independent factors and consequently an increase in the likelihood of insect plagues.

[2130]. 13.15 : 13.2. GALOUX, A. Le complexe biologique des Ipides. [**The biological complex of the Ipidae.**] *Commun. Sta. Rech. Groenendael* (*Sér. C*) No. 9, 1947. pp. 24. [F.f.g.e.flem.]

13.2. *Special (Systematic) Zoology*

[2131]. 13.2 : 01.2 (410). **Common names of British insects and other pests. Part 1. Slugs and snails: eelworms: beetles: flies: sawflies, wasps and related insects.** Association of Applied Biologists [47 Tennyson Road, Harpenden, Herts.] 1947. pp. 30.

[2132]. 13.2 : 01.2. FREEMAN, T. N. **A new generic assignment for *Archips fumiferana* (Clemens), the Spruce budworm (Lepidoptera, Tortricidae)—[transferred to the genus *Choristoneura*].** *Canad. Ent.* 79 (2), 1947 (21). O.R.S.

2. SILVICULTURE

See also *For. Abstr.* 9 (No. 2106).

[2133]. 2 : 12.26–8 (493) : 44.3 : 73. ALVIELLA, G. D'. La culture du peuplier. **[The cultivation of Poplar.]** *Bull. Soc. for. Belg.* 54 (3/4), 1947 (97–128). [F.]

Extract from Vol. 2 of the *Cahiers forestiers*, now in process of publication, dealing mainly with the silviculture of *Populus monilifera*, its yield and utilization per cent., and the principal fungus diseases to which it is subject. [Cf. *For. Abstr.* 9 (No. 2558).]

[2134]. 2 : 09.7 (51) : 12.19.2. TENG, S. C. **The forest regions of Kansu and their ecological aspects.** *Bot. Bull. Acad. Sinica* 1 (3), 1947 (187–200 + map).

The province of Kansu can be divided into five main vegetational regions. (1) *The steppe and desert of Hosi*, mainly grazing country, where only xerophytes really thrive. Indigenous species could be planted here to fix shifting sand and reclaim alkaline areas. (2) *The Spruce forest of Kilienshan*, which forms the northern limit of the East Tibetan plateau. The area east of Chiayukuan, once a continuous forest, now has a forest area of only 270 sq. miles. It consists of a single climax dominant, *Picea asperata*, with *Juniperus tibetica* and *J. saltuaria* occurring as preclimax dominants on southerly aspects. *P. asperata* reproduces readily in openings as wide as the height of the surrounding trees. Clear cutting in strips 100 to 120 ft. wide at right angles to the prevailing wind is recommended, along with the working of the duff and moss layer into the mineral soil. Fire should not be allowed to destroy the mycorrhizae which are essential here to the development of Spruce seedlings. The Juniper stands have been largely destroyed by firing and grazing, but natural regeneration should follow their control. (3) *The deforested loess highland.* This area once had continuous forest cover, probably *Pinus tabulaeformis/Quercus liaotungensis*, but *Ulmus pumila* is now the most flourishing survivor. Reforestation is difficult but should be possible if the climatic cycles of the region are taken into account and firing and grazing controlled. Where the original climax species cannot be used, planting of *Ulmus pumila*, *Robinia pseudoacacia*, *Ailanthus altissima* and *Sophora japonica* is recommended for altitudes below 5,000 ft., the same species except *R. pseudoacacia* for 5–6,000 ft., and above that, *U. pumila*. Two-year-old sturdy nursery stock is essential. (4) *Pine/Oak woodland of Tsingling.* Here, in a more humid climate, the forest composition is more complex than that of the loess highland, and the *Pinus armandi/Quercus aliena* var. *acuteserrata* association is found. The forests remaining are confined to the more inaccessible areas. They have been extensively worked and Birch and Aspen are now more abundant than Pine and Oak. The author recommends that cutting should be concentrated on Birch and Aspen, while seed trees of Pine and Oak should be left. (5) *Spruce/Fir forest of Minshan.* All the forests of this region belong to the *Abies faxoniana/Picea purpurea/P. neoveitchii* association, but the area falls into 3 distinct topographical units, the forest composition increasing in complexity southwards. In the Towho and Peilungkiang watersheds, silvicultural treatment should aim at restoring the dominance of the climax species, especially *P. purpurea* and *P. neoveitchii*, and suppressing the Birch/Aspen associes. Where seed trees of *P. neoveitchii* are present, Birch, Aspen and *P. asperata* stands should be selectively cut to favour its reproduction. In pure *P. neoveitchii* stands, cuttings may be made in good seed years in strips not wider than twice the diameter of the dominant tree crowns and, where suitable openings already exist, undergrowth should be cut and the ground hoed. A further opening of the canopy is desirable after establishment. When *P. neoveitchii* is absent *P. asperata* or *Pinus armandi* should be favoured. In the *Picea purpurea* consociation the strips should only equal in width the diameter of the dominant tree crowns and should be sheltered from direct sunlight.

In the *Abies faxoniana* consociation a mixture of Fir with *Larix potaninii* is preferred. Where Larch is present about 70 per cent. of the Fir stand should be removed during the first cut; in the absence of Larch, mixed stands of Fir and *P. asperata* are desirable. On southerly slopes the Juniper sub-climax and Pine/Oak associes should be maintained. In the more

complex forests of the Peishuikiang watershed the same policy of eliminating undesirable species and releasing desirable trees should be followed. In the whole province of Kansu, which may be said to typify the forest problems of China, only about 1·6 per cent. of the land area is under forest cover, although it seems certain that over 50 per cent. of the land could grow timber.

21. SILVICULTURAL CHARACTERS OF TREE SPECIES

See also *For. Abstr.* 9 (Nos. 2167, 2231–2).

[2135]. 21 : 12.25–8 (51) : 23.2 : 31.0. TENG, S. C. **Silviculture of Kansu trees.** *Bot. Bull. Acad. Sinica* 1 (3), 1947 (221–42 + plates).

Gives the salient silvicultural characters and chief uses of about 40 of the more important Kansu tree species and some important shrubs, along with tables of tolerance and soil moisture requirements, diagrammatic presentation of altitudinal distribution and sketches of root and shoot systems. Species treated are:—*Ginkgo biloba, Taxus chinensis, Cephalotaxus drupacea, Pinus bungeana, P. tabulaeformis, P. armandi, Abies faxoniana, A. sutchuenensis, A. chensiensis, Picea asperata, P. purpurea, P. neoveitchii, P. complanata, Larix potaninii, Tsuga chinensis, Cupressus tereta, Thuja orientalis, Juniperus* spp., *Populus davidiana, P. cathayana, Salix* spp., *Juglans regia, Betula* spp., *Quercus aliena* var. *acuteserrata, Q. liaotungensis, Q. spinosa, Ulmus pumila, Morus alba, Broussonetia papyrifera, Berberis* spp., *Cotoneaster* spp., *Prunus tangutica, Caragana* spp., *Gleditsia sinensis, Sophora japonica. Robinia pseudoacacia, Ailanthus altissima, Melia azedarach, Aleurites fordii, Zizyphus jujuba, Tamarix chinensis, Hippophae rhamnoides, Elaeagnus angustifolia, Rhododendron* spp., *Diospyros* spp., *Catalpa* spp., *Arundinaria* sp. [cf. *For. Abstr.* 9 (No. 2604–5).].

[2136]. 21 : 12.25 (479) : 12.19 : 23.27 : 45.3. LOZOVOY, D. I. Eldarskaya sosna i ee ustoychivost' v otnoshenii vrednýkh nasekomýkh. [***Pinus eldarica* and its resistance to insect pests.**] *Priroda, Moskva* 36 (9), 1947 (74–6). [Russ.] D.S.I.R.

P. eldarica is decorative, highly drought-resistant, and will grow on stony ground. Its only known habitat where natural regeneration occurs is the El'dar-oush ridge, about 600 ft. above sea level, in the E. Georgian steppe country, which has hot summers, comparatively mild winters, and an annual precipitation (chiefly late autumn or early spring) of 400 mm. The trees are only 12–15 m. high, with much taper and (owing to wind) are extremely crooked, growing as isolated specimens among or forming small groves with Juniper thickets. In the natural habitat (only 118 ha.) the area actually bearing this species is not more than 50 ha., carrying about 2000 trees. Owing to its resistance to unfavourable environmental factors it is now recognized as the best ornamental and street tree for shallow stony sites in the drought regions of Georgia, and fine specimens are to be seen in Tiflis and its environs, where *P. sylvestris* has been largely a failure. It has a very well developed root system, with a strong taproot, but though drought-resistant it responds well to watering. Its high degree of resistance to insects, especially *Evetria buoliana*, which is an extremely destructive pest of *P. sylvestris* in Georgia, is attributed to the high resin content of its heavy, narrow-ringed wood. The author has never found bark-beetle attack on this species.

[2137]. 21 : 12.26–8 (881) : 31.0. FANSHAWE, D. B. **Studies of the trees of British Guiana. II. Greenheart (*Ocotea rodiaei* (Schomb.) Mez.).** *Trop. Woods* No. 92, 1947 (25–40).

[Cf. *For. Abstr.* 9 (No. 811).] Information given includes vernacular names, botany and ecology, silviculture, properties and utilization.

[2138]. 21 : 12.26–8. CARIFOR. La sylviculture de l'acajou amer. [**The silviculture of *Cedrela mexicana*.**] *Rev. int. Bois* 14 (122/123), 1947 (151–2). [F.]

21.0. *Adaptability to the General Environment. Acclimatization*

See also *For. Abstr.* 9 (Nos. 2064, 2194).

[2139]. 21.0 (481 : 410) : 12.25. FROST, F. Bruk av fremmede treslag : erfaringer fra Storbrittania. [**Use of exotic tree species: experience in Great Britain.**] *Tidsskr. Skogbr.* 55 (6/7), 1947 (206–14). [Nor.]

Brief notes on the behaviour in Great Britain of some exotic conifers thought to be of special interest for use in Norway. Particular

mention is made of *Picea sitchensis*, *Pseudotsuga taxifolia*, *Tsuga heterophylla*, and *Pinus nigra* var. *calabrica*. Others of possible interest are *Larix leptolepis*, *L. eurolepis* and *Abies grandis*.

[2140]. 21.0 (493) : 12.11.3. ALVIELLA, G.D'. L'introduction des essences exotiques en Belgique. [**The introduction of exotic species into Belgium.**] *Bull. Soc. for. Belg.* 53 (3, 5, 6/7, 8, 9, 10, 11/12), 1946 (49–67, 145–62, 252–73, 312–28, 337–47, 410–27, 441–52). [F.]

The first part of this study is an examination of the fundamental bases for acclimatization (variability, provenance, evolution of species, adaptability to edaphic and climatic conditions, etc.); the second part is a detailed account of all known experiments in acclimatization of European Larch and Douglas Fir. Larch has hitherto been generally a failure, perhaps chiefly because only Alpine races have been used. It is suggested that Larch of Silesian provenance would probably be more successful. The most promising species are Green Douglas Fir, *Thuja plicata*, *Abies grandis*, *Quercus borealis*, *Q. palustris*, *Liriodendron tulipifera*, *Pinus nigra* vars. *austriaca* and *calabrica*.

[2141]. 21.0 (493) : 12.25. GALLOT, R. Le sapin argenté dans l'Ardenne belge. [***Abies alba* in the Belgian Ardennes.**] With comment by 'A. H.'. *Bull. Soc. for. Belg.* 53 (5), 1946 (162–87). [F.]

Gallot reviews the literature on the subject at some length and concludes that Silver Fir, provided that it is established in a suitable climate (e.g. the Ardennes, in Belgium), on suitable deep soils, and in forests where game is kept within normal limits, can greatly increase the yield of many broadleaved forests and ensure a sustained yield. 'A. H.' agrees with these conclusions, but defines the requisite conditions more closely, i.e. sandy, porous, fairly deep soils on which Spruce does not do well; optimum altitude 250–400 m.; and mentions the plant associations that indicate suitable sites, e.g. light grass cover, a light growth of fern and raspberry bushes, or best of all, a shrub growth of Service tree, Red Elder, Willow and Birch; Bilberry is tolerated, but Heather is a contra-indication.

[2142]. 21.0 (493) : 12.25 : 12.19.2 : 64. BOUDRU, M. L'aire virtuelle, en Belgique, du sapin pectiné (*Abies alba* Mill.). [**The potential range of Silver Fir in Belgium.**] *Bull. Soc. for. Belg.* 53 (6/7), 1946 (207–52 + map). [F.]

The author analyses the floristic data for those forest regions in Europe where *Abies alba* is dominant, and concludes that *Sambucus racemosa* and *Prenanthes purpurea* are its invariable associates, with the addition of *Polygonatum verticillatum* on the more mountainous sites. Apart from these three, the associates of *A. alba* are very variable. He then investigates the distribution of *S. racemosa* and *P. purpurea* in Belgium and divides upper Belgium into 3 regions according to their relative suitability for growing Silver Fir. This division agrees with that obtained by applying Martonne's values for the index of aridity. *From author's summary.*

[2143]. 21.0 (493) : 12.25 : 12.11.3. BOUDRU, M. Notes sur les races locales de cyprès de Lawson, *Chamaecyparis lawsoniana* Parlatore, et l'interêt de leur introduction en Belgique. [**Notes on the local races of *Chamaecyparis lawsoniana*, and the possibilities of introducing them into Belgium.**] *Bull. Soc. for. Belg.* 52 (9/10), 1945 (99–114). [F.]

Briefly considers the technical qualities of wood of Port Orford Cedar and the possibilities of growing it in Belgium. Analysis of the meteorological data shows the variety of climate in the natural range of the species. The races from the Pacific Coast could probably not stand the dry winds of the Belgian winter, but those from the eastern, inland part of its range should be quite suitable. The isolated stands in Northern California might provide suitable strains for planting on the high plateaux of the Ardennes. *From author's summary.*

[2144]. 21.0 (759). WESTGATE, P. J. **Forestation studies.** *Rep. Fla. agric. Exp. Sta.* 1945 (138).

A survey was made in January, 1945, of seedling trees of Brown Mahogany (*Entandrophragma* sp.), Rhodesian Mahogany (*Khaya nyasica*), Balsa (*Ochroma lagopus*) and *Garcia nutans*, distributed to co-operators in south-central and south-western Florida during the past few years. Almost all unprotected Balsa seedlings were killed by temperatures of 28° F. *Garcia nutans* was more hardy and most of the young plants were found still alive. The *K. nyasica* and *Entandrophragma* seedlings planted in hammocks or in protected areas near buildings were making good growth. The seedlings which had been set out in open, unprotected

areas were almost all killed by a combination of hurricane, drought, and frost. *K. nyasica* planted among Caribbean Pine continued to make good growth.

21.3. *Soil Requirements*

See also *For. Abstr.* 9 (No. 2558).

[2145]. 21.3. DIMBLEBY, G. W. **Soil conditions and tree growth. II. Soil factors.** *Repr.* from *Chem. & Ind.* 1947 (37), (560–2).

A discussion of two soil factors affecting tree growth, viz. pore-space and aspects of colloidal behaviour.

[2146]. 21.3 : 12.25. **[Nutriment requirements of *Pinus caribaea* and *P. taeda*.]** *Rep. Dep. Agric. Qd. 1946–7*, 1947 (41).

Analyses were made of soil, litter, and fresh needles from the various plots of a field trial of *P. caribaea* and *P. taeda*. Results show that the nutritional requirements of the two species differ appreciably, and a close relationship appears to exist between the uptake of the elements aluminium and phosphorus.

[2147]. 21.3 : 12.26–8 (485) : 11.49.0 : 11.42.31. WEIMARCK, H. Bidrag till Skånes flora. **[Contributions to the study of the flora of Skåne. [37. Distribution and ecology of *Quercus petraea*.].]** *Bot. Notiser* 1947 (3), (189–206). [E.] O.B.D.

In Skåne *Quercus petraea* occurs only on gneiss moraine and similar leached soils. A physical analysis of the soil horizons was made and the results are tabulated. Samples from the A_0 layer had a pH of 3·6–4·3. At greater depths, and with diminishing proportions of humus, pH rises and reaches about 5·3–5·8 at a depth of 1–1·5 m. The preference of *Q. petraea* for acid soils was confirmed by sowings in spring at Lund, on 5 soils of varying alkalinity. At the end of the summer, it could be observed that the plants diminished in size with increasing alkalinity of the soil. It is thought that the effect of the oceanic climate on the soil in Skåne (i.e. the formation of raw humus and leaching) may have a greater ecological influence on the development of the Sessile Oak than the direct effects of the climate, apart from the duration of the winter.

21.8. *Phenology*

See also *For. Abstr.* 9 (No. 2517).

[2148]. 21.8 : 12.25 : 56.01 (479). GULISASHVILI, V. Z. Periodichnost' i ritm rosta sredizemnomorskikh sosen kak priznak rodstvennoy svyazi ikh mezhdu soboy. **[Periodicity and rhythm of growth of Mediterranean Pines as an indication of their mutual affinities.]** *Dokl. Akad. Nauk S.S.S.R* (*n.s.*) 57 (9), 1947 (955–8). [Russ.] [Tbilisski Botanicheski Sad.] D.S.I.R.

In a 3-year study of the periodicity of height growth and duration of the growing season of 7 species of Pine grown at Tiflis, it was found that: (1) The start of the growing season was practically the same for all the species. (2) *P. laricio* Poir., *P. sylvestris* L. and *P. pinea* L., normally formed only one internode per growing season. The first two species had a short growing season finishing at the end of May or the beginning of June, and the last-named ended its height growth in mid-June. (3) *P. halepensis*, Mill., *P. maritima* Lamb.[?], *P. pithyusa* Stev. and *P. eldarica* Medw., formed 2–3 (the last-named sometimes 4 or 5) internodes per season, their height growth continuing until 1–15 August or even longer (*P. pithyusa* and *P. eldarica* into September and October respectively in 1946).

These facts are peculiar as (*a*) the first three species finished height growth in still favourable climatic conditions, and (*b*) the four latter continued height growth even in unfavourable ones (drought). On these grounds and from fossil evidence it is inferred that the four latter species, which are closely related, are ancient relicts (from a possibly tropical tertiary period) which are no longer in step with Mediterranean seasons. *P. pinea* may well be a species of recent origin, well adapted to its environment, while *P. laricio* and *P. sylvestris* evolved in more temperate conditions.

22. SILVICULTURAL SYSTEMS. FORMS OF STAND

22.1 *High Forest Forms*

See also *For. Abstr.* 9 (Nos. 2156–7, 2312).

[2149]. 22.1 (485) : 23.1 : 09.1. WELANDER, P. O. Huggningsformer och föryngring på de norrländska skogarna. **[Types of fellings and**

regeneration in the forests of Norrland.] *Norrlands SkogsvFörb. Tidskr.* 1944 (4), (309–43) [Sw.]

A historical review. In both private and state forests, cutting to diameter has prevailed, whereas it is estimated by the author that about 80 per cent. of the productive forest area of the region fails to give satisfactory natural regeneration under this system, and clear felling is believed to be necessary as a general rule. In spite of the showings of experimental work and of protests in the Swedish Parliament, the State Forest Service has only recently recognized the extent of the areas in need of regeneration, but now that it has done so a switch-over to less stereotyped and more realistic silvicultural practices is expected.

[2150]. 22.14.2 : 12.25 : 56 : 24.3. ROE, A. L. **What is the right cutting cycle for Ponderosa Pine?** *Res. Note Nth. Rocky Mt. For. Range Exp. Sta.* No. 57, 1947. pp. 3.

The rule that frequent light cuts in Ponderosa Pine produce greater yields has long been recognized by foresters [cf. *For. Abstr.* 8 (No. 1018)]. Analysis of growth by 5-year periods in a 35-year-old cutting on the Bitterroot National Forest [cf. *For. Abstr.* 9 (No. 1937)] shows how the principle has worked out in this instance.

22.2. *Coppice Forest*

See also *For. Abstr.* 9 (Nos. 2030, 2615).

[2151]. 22.2 : 12.26–8 : 32.7. DOWNS, A. A. **Losses from high stumps in sprout Oak stands.** *J. For.* 45 (12), 1947 (903–4).

Report of a study made to determine the quantity of wood lost in Appalachian stands of White Oak of coppice origin by the unavoidable high cutting of trees having swollen or fused bases. The loss amounted to 5–8 per cent. of many trees. Much of this loss could be prevented by thinning the coppice growth to one shoot of low origin at an age of 8–15 years.

23. FORMATION OF STANDS

See also *For. Abstr.* 9 (Nos. 2051–3, 2618, 2649).

[2152]. 23 : 12.26–8 : 45.12. **[Regeneration of *Baikiaea plurijuga* forest.]** *Rep. For. Dep. N. Rhod. 1946*, 1947 (6).

The problem of obtaining adequate regeneration in the Mukusi or Rhodesian Teak (*Baikiaea plurijuga*) forests in Northern Rhodesia has not yet been solved. The long period during which the pods hang on the trees makes them very susceptible to damage by baboons, and on the ground both seeds and seedlings are attacked to such an extent by rodents, especially mice and squirrels, that artificial sowings *in situ* have invariably failed for this reason alone. The attraction is the large, succulent cotyledons; once these are shed or withered the chances of survival of seedlings should be much improved. Experiments are being made in nursery and transplanting methods.

23.1. *Natural Regeneration*

See also *For. Abstr.* 9 (Nos. 2101, 2535–6).

[2153]. 23.1 : 12.25 : 22.88.2 (713). LARSSON, H. C., and WILKES, G. C. **Forest regeneration survey on cut-over Spruce and Pine lands in the Thunder Bay and Western regions [Ontario].** *Res. Rep. Ont. Dep. Lds. For.* No. 14, 1947. pp. 45 + 6 + tbls.

The virgin stands in the Thunder Bay Region are composed of 3 major forest cover types:—Spruce/Fir, Spruce, and Pine. The uncut stands are well stocked to Balsam Fir and Spruce, as are cut-over areas generally, except clear-cut Jack Pine stands. Fires occurring in virgin stands usually produce adequate regeneration of Spruce and Balsam Fir, or Jack Pine, depending on the cover type and the availability of seed; whereas burnt cut-over areas are usually understocked or a failure in all three. Cutting and fire appear to stimulate Poplar and White Birch reproduction. Age studies indicate that over 80 per cent. of the reproduction came in before or during logging. *From authors' summary.*

[2154]. 23.1 : 12.26–8 : 34.27 : 21. **[Mulga (*Acacia aneura*) treatment and regeneration.]** *Rep. Dep. Agric. Qd. 1946–7*, 1947 (35–6).

A preliminary report on a field study of Mulga (*Acacia aneura*) regeneration. Four fairly well-defined growth forms are found:—(1) *Low Mulga*, a low shrub, much branched from about ground level and usually forming dense stands; growth form due to grazing.

(2) *Whipstick Mulga*, small trees up to 10 ft. high, growing close together; found only where dense regeneration has grown up untouched by stock. (3) *Umbrella Mulga*, medium-sized trees up to 30 ft. high, forming either closed forest or open parkland. This form shows Mulga at its best; it flowers fairly regularly and often produces ripe seed. (4) *Tall Mulga*, medium-sized trees up to 40 ft. sometimes forming closed forest; often growing in shallow, hard, red-brown soils on ridges. This form appears to be Mulga in old age; the leaves are tough, thin, and hard but are relished by sheep and cattle.

The studies so far indicate that:—(*a*) Mulga will grow readily from seed if given proper conditions of moisture, temperature and light. (*b*) Cutting, burning, or bending down destroys Mulga trees. (*c*) Lopping above the lowest lateral branches does not usually destroy Mulga trees. (*d*) Thinning of dense stands increases the amount of ground vegetation and improves the remaining trees. (*e*) Stocking with sheep will prevent young Mulga establishing itself. (*f*) Fire stimulates growth of Mulga seedlings for a short time, but areas burnt over several years before suitable rainfall may be left devoid of seed. (*g*) Mulga grows very slowly in the paddocks, but may grow quite rapidly in favourable situations.

[2155]. 23.1 : 12.26–8 (591) : 24. ALLSOP, F. **Natural regeneration of Teak in Mong Mit forest division, Shan States, Burma.** *Indian For.* 73 (9), 1947 (399–400).

In some parts of this forest division there is much natural regeneration of Teak, locally as dense as an ordinary plantation. The prescribed cleaning and thinning operations are described.

[2156]. 23.11.4 : 12.26–8 (489) : 22.12.1. KRARUP, F. Langsom Bøgeselvforyngelse. **[Slow natural regeneration of Beech.]** *Forstl. Forsøgsv. Danm.* 19 (1), 1947 (81–104). [Dan.f.]

In Denmark, natural regeneration of Beech is generally obtained with much heavier opening of the canopy than is customary in France and Switzerland, and seedbearers are removed within a relatively short period. To discover whether regeneration fellings could be spread over 20–25 years, an experiment was started in the mast year 1926 on plots of 128-year-old Beech in Als Nørreskov, on the coast of Sønderborg. The whole of the area was harrowed, and on one plot, next to the sea, the moss layer had to be removed. Fellings were made in 1926, 1930, 1934 and 1937, removing respectively 12, 15, 18 and 20 per cent. by volume. Further fellings took place in 1939, 1942 and 1944, when the experiment came to an untimely end owing to a mistake in the fellings. Except for the plot nearest the sea, where satisfactory natural regeneration is judged to be impossible, excellent regeneration was obtained. Seedlings under old trees showed only slightly less height growth than those in gaps. The seedbearers put on an average annual increment for the period 1926–44 of 7·9 cu.m. per ha., and this mostly on trees of high quality. Further advantages of the gradual fellings are protection of the soil, decreased risk of frost damage, and prevention of invasion by grass. The method appears to have a future for good Beech sites in Denmark.

[2157]. 23.11.4 : 12.26–8 (489) : 24.2 : 24.3 : 22.13. BORNEBUSCH, C. H. Bøgeskovens Behandling paa Boller Skovdistrikt. **[The treatment of Beech forest in the Boller Forest District.]** *Forstl. Forsøgsv. Danm.* 19 (1), 1947 (1–80). [Dan.f.]

Describes the treatment applied by E. Moldenhawer to Beech stands in Randskov and Grundskov, Vejle Fjord. When this officer took over the district in 1914 the Beech woods were about 90 years old and had been very lightly thinned up to that date. Moldenhawer's treatment consisted in heavy and frequent thinning over the whole area, with the primary object of removing inferior trees and securing increment on the most valuable timber, followed by the gradual opening and removal of the old wood by groups to favour the advance growth which appeared. As such groups were created not to initiate but merely to encourage existing regeneration, their distribution is quite irregular.

When the area was taken over in 1931 by the Danish Forestry Research Organization, 87 per cent. of the Randskov was adequately stocked with Beech regeneration in mixture with or interrupted by pure groups of Ash. The quality of the regeneration was on the whole good.

The old stands have benefited in quality by the selection practised in thinning; crown development and diameter increment have also

improved. In spite of the heavy thinnings (growing stock per ha. was reduced from 362 cu.m. in 1914 to 351 cu.m. in 1924 and 337 cu.m. in 1931–32), volume increment has been maintained except where the canopy has been interrupted. The failure of most trees in the regeneration groups to react to opening, is attributed to the extremely cautious treatment before 1914 and the suddenness of the transition to open conditions, to which the trees were consequently for the most part unable to adapt themselves.

Moldenhawer's treatment is regarded as a very promising one, though great personal attention is needed on the part of the forest officer. Biologically and aesthetically, the condition of the woods is extremely satisfactory.

The French summary includes translations of table headings and captions to illustrations.

[2158]. 23.13 : 07.7. VINEY, R. Une méthode moderne de crochetage. [**A modern method of wounding the soil.**] *Rev. Eaux For.* 85 (11), 1947 (671–5). [F.]

Description of a mechanical tractor-drawn cultivator 'La landaise' and its use in preparing the soil for natural regeneration. It consists of two sets of rollers, set at an angle to each other, and each furnished with 6 blades. The tractor can carefully work over one hectare of forest in an 8-hour day, consuming 35–40 kg. of charcoal. Where seed is lacking, good results are obtained by sowing broadcast between two cultivations.

23.2. *Artificial Regeneration*

[2159]. 23.2 : 12.25 (485). TIRÉN, L. Försök med sådd och plantering. [**Experiments on direct sowing and planting [of Scots Pine and Norway Spruce in Norrland**].] *Norrlands SkogsvFörb. Tidskr.* 1944 (2), (85–122). [Sw.]

Reports on trials established between 1913 and 1927 by the former Norrland Branch of the Swedish Forestry Research Institute. As these antedate the introduction of statistical design in field trials, the results are admitted to be of limited validity. On the whole, the trials were disappointing, a fact attributed to various factors, e.g. lack of skilled labour, use of unsuitable provenances, old seed or poor planting stock, unfavourable sites (frost lift and weed growth being troublesome on some).

So far as the results go, they indicate that: (1) Sowing or planting were about equally successful. (2) Loosening of the soil previous to sowing in patches gave inferior results. (3) In plantings, the nature of the earth fill had a marked effect on height growth in the first 15 years or so, addition of nitrogenous bog soil being favourable to growth. Plants receiving no such supplement, however, appear to have gradually caught up in growth, but further investigation of this matter is necessary. (4) Results from planting in pits and in crow-bar holes were practically uniform, hence the latter method is to be preferred for its cheapness. Notching did not appear to be a good method, but has so far been tried on a restricted scale and might possibly prove suitable in a modified form. [Cf. *For. Abstr.* 8 (No. 208); 9 (No. 2052).]

[2160]. 23.2 : 82 (485). FLODMAN, B., and STAAF, G. Studie av sådd- och spettplanteringsmetoder våren 1943.—En arbetsstudie. [**A time study of methods of sowing and crowbar planting in spring 1943.**] *Norrlands SkogsvFörb. Tidskr.* 1943 (3), (227–57). [Sw.sw.]

[2161]. 23.2 : 12.26–8 (666.8 : 669) : 21 : 56 : 31.0. AUBRÉVILLE, A. Les bois, richesse permanente de la Côte d'Ivoire et du Cameroun. [**Wood, lasting wealth of the Ivory Coast and the Cameroons.**] *Agron. trop.* 2 (9/10), 1947 (463–89). [F.]

A study dealing with the exploitation and management of the forests of the Ivory Coast and the Cameroons, and with methods of artificial restocking with desirable species. Large-scale experiments were first begun on the Ivory Coast in 1931, in the Banco forest near Abidjan and in the Yapo forest. Strips, at first 10 and later 20–25 m. apart, were cleared and planted with various species, at 2·5-m. and later 5-m. spacing. The forest cover was opened up laterally year by year to allow light to penetrate. Statistics showing mortality percentage and increment, gathered in 1939 and 1946 from the Yapo forest, are given. They show an excessive irregularity of development partly due to the nature of the soil and to competition from other vegetation. Numerous losses were sustained, which average 17 per cent. but vary with the species and the amount of light admitted to the plot by constant clearing of the undergrowth and opening of the

canopy. The greatest degree of homogeneity was attained by *Mimusops heckeli*, which is tolerant of shade, but its growth on the whole was only mediocre. The results of the experiments were considered adequate but their cost was unexpectedly high.

Other experiments were made by planting up land first cleared and cultivated by the native population, and then abandoned by them. *Tarrietia utilis* and *Terminalia ivorensis* were planted in the Banco forest in 1933. *Tarrietia utilis* showed a much greater increment on the agricultural clearings, than in the strip-planting trials, the percentage of main crop trees being 38·5 as compared with 18·2–20·7 on the strips. Growth by both systems is slow until the tree attains a height of about 15 m. *T. utilis* had an average annual growth of only 0·65 m. during the first 8 years. If a considerable number of tall trees is required, the crown must be freed yearly for 6 years, and every 2 or 3 years subsequently until the stand attains a height of about 15 m. The ground around a seedling must also be freed of roots within a radius of at least 0·5 m. Light is also of paramount importance. In the strip system as much light as possible should be allowed from the second year onwards, although this naturally involves constant cleaning and is costly. Insect attack was severe, particularly in the case of *Khaya ivorensis* and *Entandrophragma cylindricum*. The author believes that the strip system should give place to planting on agricultural clearings where these are available and the forest is very dense.

Experiments in the Cameroons in the protection forests of Ottotomo in 1931 and Makak in 1938, gave similar results. Some growth and survival statistics for *Khaya ivorensis*, *Triplochiton scleroxylon* and *Entandrophragma cylindricum* are given.

Suitable species are listed with their silvicultural characteristics and the uses of their timbers. For the Ivory Coast, *Tarrietia utilis*, *Mimusops heckeli* and *Entandrophragma utile* are recommended for the most humid districts, with *Khaya* spp., *Entandrophragma cylindricum*, *Lovoa triclisioides*, *Turraeanthus africanus*, *Guarea cedrata* and *Chlorophora excelsa* as secondary constituents; in the drier northern regions, *Terminalia superba* and *Triplochiton scleroxylon*, with a mixture by groups of *Khaya* spp. *E. cylindricum*, *L. triclisioides*, *G. cedrata*, *C. excelsa*, *Mansonia altissima* and *Terminalia ivorensis*. In the Cameroons, some desirable species from the local forests would be added.

Assuming such a plan to be economically feasible, the author envisages a rehabilitation programme by which 200,000 ha. would be restocked every 5 years for 20 years, giving a yield of at least 250 cu.m. of timber per ha. from the 60th year onwards.

23.22. Preparatory Work. Auxiliary Measures

See *For. Abstr.* 9 (Nos. 2181, 2194, 2535–6).

[2162]. 23.22.1 : 07.7 (492). HOUTZAGERS, G. Mechanisatie in de bosbouw: de economische en bosbouwkundige zijde van het vraagstuk. [**Mechanization in forestry: the economic and silvicultural aspects of the problem.**] *Ned. Boschb.-Tijdschr.* 19 (12), 1947 (337–42) [Du.]

From an investigation of the production cost of Scots Pine in Holland [see *For. Abstr.* 9 (No. 1961)] it is inferred that *f.* 200–250 per ha. is the maximum that can be spent on site preparation for this species, and that even with the subsidy of 50 per cent. of costs for such work [see *For. Abstr.* 8 (p. 462)] it will be uneconomic to use manual labour unless timber prices rise. Stump clearing costs *f.* 150–200 per ha., leaving little for cultivation if a subsidy is not obtained. With the subsidy, which can be claimed for most of the land needing artificial regeneration, the maximum that can be spent on site preparation becomes *f.* 400–450. For Larch, Douglas Fir and mixed forest, yields may be higher, but the higher initial costs should not be overlooked. The Forest Service estimates the costs per ha. for planting and beating up as respectively *f.* 930, *f.* 1175 and *f.* 920, as compared with *f.* 470 for direct sowing, *f.* 505 for planting of 1/0 and *f.* 605 for that of 2/0 Scots Pine. Costs of site preparation should therefore not exceed those for the last-named species.

The chief points made as regards mechanical cultivation are that: (1) A radical distinction must be drawn between soils needing deep cultivation and those where shallow working will suffice. Most of the deforested areas are of the latter type. (2) The best mechanical

cultivation is that which secures maximum activation of the humus by mixing it intimately with the mineral soil. This would also favour the use of direct sowing, which is believed to be superior to planting from both silvicultural and economic points of view.

Standard figures for the costs and advantages of any particular form of mechanical cultivation are not and may never be available, since combinations of soil type, ground cover, and obstacles are so numerous that each case has to be considered on its merits.

[2163]. 23.22.1 : 07.7 (492). BAN, P. A. VAN DEN. Gebruik van werktuigen voor de grondbewerking ten behoeve van de bosbouw. [**Use of implements for soil cultivation in forestry.**] *Ned. Boschb.-Tijdschr.* 19 (12), 1947 (343–9). [Du.]

[2164]. 23.22 : 07.7 (492). BAKKER ARKEMA, P. W. Verslag van de demonstratie van bosbouwwerktuigen te Austerlitz op 11 October 1947. [**Report on the demonstration of forestry implements at Austerlitz, 11 Oct. 1947.**] *Ned. Boschb.-Tijdschr.* 19 (12), 1947 (351–7). [Du.]

Van den Ban's article is an introductory talk on the occasion of a demonstration of implements at Austerlitz, which is briefly described by Arkema.

Brief reference is made to implements already used in Holland for deep cultivation of regeneration areas. For shallower working the chief types of implement are disk-ploughs, forest (ridge-type) ploughs, disk harrows and rotary tillers.

Particular mention is made of the light forest plough devised by Geerling [see *For. Abstr.* 9 (No. 1536)]. This plough leaves the bottom of the furrow usually too compact for sowing or planting, and the necessary loosening is done by a cultivator also invented by Geerling, the combined operation often costing *f.* 50 per ha. The method was demonstrated successfully on ground with lightish cover. Geerling's plough also did good work in cultivating between rows in a young plantation. Geerling's implements, however, are not heavy enough for deep humus with much *Vaccinium*, heather, etc. For sites that are not too overgrown, two disk-harrowings at right angles to each other may be sufficient.

Types of rotary cultivator are discussed, with the conclusion that the Rotary Hoe cultivator, drawn by a Fordson Major tractor (28 h.p.) is possibly the most suitable for forestry work. This implement has well spaced cutters, giving little trouble from clogging up, and results in the demonstration were favourable. The Fishling and Till-Mor rotary cultivators, both drawn by Farmall M tractors (35 h.p.) were also tried. Rotary tillers are, on the whole, more adapted to horticultural work. For the heavy going encountered on regeneration areas they need a great deal of tractive power, those with many cutters tend to clog up with vegetation, and wear would possibly be severe. Use of a heavier tractor is uneconomical, as too much power would be left unused on other jobs. Possibly, however, it might pay to achieve the same effect by reducing the cutters to work a narrower strip.

On land with widely spaced stumps and not too heavily overgrown, the disk-plough is useful. Costs exceed *f.* 100 per ha., as the ground has to be worked twice in directions at right angles to each other. Only old models are available at present in Holland. An Oliver disk-plough drawn by a McCormick tractor (25 h.p.) did well in the demonstration, jumping the stumps extremely well.

For cultivation in young plantations use may be made of Geerling's plough (see above), or if ground cover is fairly light, of the '*bosegel*' (a narrow cultivator with 3 sprung teeth) or roto-tillers, e.g. the Howard Rotary Hoe, a multi-purpose machine which can be adapted as a small plough, a ridging implement, etc.

Other implements demonstrated were a heavy German forest (ridge-) plough, the Hornet chain-saw, and two types of stump-grubber.

Several of the implements are illustrated.

[2165]. 23.22.1 : 11.42.33. VEEN, B. Het breken van een oerbank of een grindbank door middel van springstoffen. [**Breaking up iron and gravel pans with explosives.**] *Ned Boschb.-Tijdschr.* 19 (12), 1947 (350). [Du.]

A few simple trials by Egberts in Holland have shown that: (1) The charge must be just sufficient to break the pan without blowing out the soil and leaving a crater. (2) The effect under these conditions is observable for a radius of 2–3 m. from the centre of the explosion; thus charges laid at a 5-m. spacing should suffice. (3) The firing of a large number of charges is best done centrally.

Costs per ha. [type of explosive not specified] are estimated at *f.* 175 (boring and filling of 400 holes *f.* 80, 5 kg. explosive *f.* 56, firing and inspection *f.* 30, contingencies *f.* 9). Further tests are needed.

[2166]. 23.22.1 : 12.26–8 (689). **[Preparatory measures for planting Eucalypts.]** *Rep. For. Dep. N. Rhod. 1946*, 1947 (4–5).

Eucalyptus saligna and *E. citriodora* have been successfully established by adopting the native agricultural system of cutting branches in the mixed *Brachystegia* forest of the region, stacking them in large heaps, and burning them late in the dry season to create sterilized ash-gardens in which finger-millet is sown. Such burnt areas have been planted with the above-mentioned Eucalypts and, thanks to effective fire protection of the indigenous coppice regrowth all round them, these group plantings have come away well. From the point of view of timber production, best results were obtained where the burnt areas ('amakula') were as much as 2 acres in extent. Several compartments created in this way are now 12 years old and already provide useful thinnings.

23.23. Seed and Sowings

[2167]. 23.23 : 12.26–8 : 21.1 : 21.2. POINSIER, J.-L. Le parasolier, essence de reboisement pour la forêt secondaire. **[*Musanga smithii*, a species for reforestation in secondary forest.]** *Bois For. Trop.* No. 3, 1947 (31–4). [F.]

The principal argument against the use of *Musanga smithii* for reforestation in the tropical forests of West Africa has been the difficulty of securing adequate germination, but a successful method has now been developed in the Ivory Coast. Seed was collected in July and sown in pots at the beginning of September; the first germination took place about 18 days later. Light is the most important factor for the young plant, and experience has shown that the optimum illumination is about 1,900 or 2,000 metre-candles. The most successful greenhouse specimens were given this amount of lighting continuously during the normal hours of daylight except in December and January when it was increased to 19 out of 24 hours. Optimum temperature is 25–27° C. A high degree of atmospheric humidity accelerates the rate of growth and provokes the production of aerial roots. If humidity is reduced to the minimum compatible with the life of the plant, growth is greatly retarded, but the plants thus obtained are much more vigorous. The cotyledons appear during the second week after germination and persist for 5 months in the greenhouse in Europe. The first leaves appear a few days later.

23.23.1 *Seed Procurement, Treatment, and Testing*

See also *For. Abstr.* 9 (Nos. 2083, 2085).

[2168]. 23.23.1 (497.2). BODŽAKOV, P. Zlobodnevni vůprosi na našeto lesosemenno delo. **[Current problems of forest seed supply in Bulgaria.]** *Gorsko Stopanstvo* 1 (4/5), 1945 (105–10). [Bulg.]

Discusses the seed supply problem and its urgency in relation to a programme of afforestation, particularly in the denuded catchment areas of the country, the necessity for which is stressed. The organizing of seed provenance, production, storage and pre-treatment in regional stations under the Central Forestry Research Institute and in close co-operation with the executive is essential.

[2169]. 23.23.11 : 12.25 : 55. LINDROTH, S. Två gamla tallars fröproduktion. **[The seed production of two old Scots Pines.]** *Norrlands SkogsvFörb. Tidskr.* 1943 (3), (258–65). [Sw.]

Records of seed production for Scots Pines in Norrbotten are quoted to show that old trees are capable of bearing good viable seed when climatic conditions are favourable. Two of the trees were over 300 years old, and one of these—having a comparatively good crown in spite of fire scars and decay in its stem—produced no fewer than 27,097 viable seeds out of a total of 34,427 extracted over the period 1930–39.

[2170]. 23.23.13. VLOTEN, H. VAN. Zaadwinning uit vlezige vruchten met behulp van zoutzuur. **[Seed extraction from fleshy fruits with the aid of hydrochloric acid.]** *Ned. Boschb.-Tijdschr.* 19 (11), 1947 (320–21). [Du.]

Quotes, as of probable interest to foresters, results of experiments by S. J. Wellensiek and A. Groot with seed of tomato, cucumber,

melon, whortleberries, currants, etc. It was found that by crushing the fruits, adding a small quantity of commercial HCl, and allowing this to act for a short time with occasional stirring, separation of seeds and pulp was readily effected by washing in a wide-mesh sieve which allowed the seeds to drop through. The seed is then stirred with plenty of water, which, on decanting, removes most of the impurities. The best results were obtained by treating with 20 cc. of commercial acid (27 per cent. HCl by weight, sp. gr. 1·14) per kg. of fresh crushed fruit. In cucumber the germinative energy (*kiemenergie*) and germinative capacity (*kiemkracht*) were respectively 99 and 100 per cent. after this treatment, as compared with 82 and 96 per cent. for seed from fruit fermented for 3 days.

[2171]. 23.23.13 : 12.25 : 07.7. DELEVOY, G. Le désailage des graines de résineux. **[De-winging of conifer seed.]** *Bull. Soc. for. Belg.* 52 (9/10), 1947 (124–8 + plate). [F.]

Describes a pneumatic seed de-winging machine, designed and used at the Groenendael Research Station, which is easy to operate and causes a minimum of damage to the seeds. Its average output per hour, in kg. of extracted seed, is Scots Pine 4–5, Spruce 3–4, and Douglas Fir 2·5.

[2172]. 23.23.15. MILLER, P. W., and MCWHORTER, F. P. **The use of vapor-heat as a practical means of disinfecting seeds.** *Phytopathology* 38 (2), 1948 (89–101). [U.S. Bureau of Plant Industry.]

A method for disinfecting seeds by vapour-heat is described, using seeds of a number of vegetables. The data presented indicate that certain fungi are killed at relatively low vapour-heat temperatures for short exposures. Most bacteria, however, are not killed by vapour-heat treatments that are safe for seeds, and the control of bacterial seed-borne diseases by vapour-heat alone seems impracticable. Certain kinds of seeds will apparently endure considerably higher vapour-heat temperatures than are required to kill all associated fungi. The important advantages of vapour-heat treatment are (*a*) temperature control is not critical as for hot-water treatment, (*b*) treatment periods are short in comparison with dry heat, and (*c*) the difficulty of drying seed, which limits the use of hot water, is eliminated by proper vapour-heat procedures. *From authors' summary.*

[2173]. 23.23.15 : 12.26–8. CHEO, T. Y. **Observations on seed germination of *Ormosia taiana*.** *Bot. Bull. Acad. Sinica* 1 (2), 1947 (131–2).

Seed of *Ormosia taiana*, which is said to be incapable of germination, was soaked in cold water for 40 to 48 hours at room temperature (the water being changed every 6 hours), placed in a moist chamber and, when enough moisture had been absorbed, planted at a depth of 8 cm. in sandy soil and watered daily. The seed was examined after a month and then replaced at a depth of 4 cm. in sandy soil. A month after this replanting, the seeds began to germinate. Three weeks later 90 per cent. had germinated. The average temperature and average relative humidity in the greenhouse were 23·6° C. and 76·5 per cent. respectively.

[2174]. 23.23.15 : 12.25. UEBERSEZIG, M. **Successful storage of Slash Pine seed for 15 years.** *J. For.* 45 (11), 1947 (825–6).

Pinus caribaea seed was stored for 15 years, at 9–10 per cent. moisture content, in sealed glass jars, in a refrigerator kept between 35° and 38° F. Average germination, tested on peat mats, was 88·66 per cent. Seed from the same sample, tested 8 years earlier, gave 93·6 per cent. germination. [Cf. *For. Abstr.* 2 (132).]

[2175]. 23.23.15 : 12.29 : 24.4. WHITE, D. G. **Longevity of Bamboo seed under different storage conditions.** *Trop. Agriculture, Trin.* 24 (4/6), 1947 (51–3 + plate).

The flowering and fruiting of clumps of *Bambusa arundinacea* in 1945 and 1946 in Puerto Rico offered an occasion for studying the longevity of the seed under different storage conditions. The most practical method tested was storage over calcium chloride at room temperature (70–90° F.). Storage over hydrated lime or over charcoal was also a good method if refrigerated. Drying of the seed to a moisture content of about 12 per cent. definitely increased longevity of seed stored over hydrated lime under refrigeration. In other cases little or no advantage was gained by drying. When no drying agent was used, exposed seed retained viability longer than that sealed in airtight containers. A small percentage of seed of the control sample, exposed

to room conditions, germinated after 227 days. No tests were recorded for any longer period.

Bamboo seed offers an easy and economical method of propagation. A large quantity of seed of the 1945 crop was sown at a depth of ¼ in. inside a greenhouse. After about 2 months the plants were 8–10 in. high and were then transplanted to gallon cans placed under partial shade. Eight months later each plant was 3–4 ft. high with numerous side branches and additional shoots. These were planted for a windbreak at 6–ft. intervals and 6 months later a dense hedge, 10–12 ft. high had developed.

[2176]. 23.23.19. **Proposal of rules for the international control of forest seed.** [International Union of Forest Research Organizations, Stockholm.] [1947?] pp. 39.

Proposals for international rules for seed testing, under the following headings:—selection of samples, estimating the appearance of the seed, testing the purity of the seed, determination of the germinative capacity, determination of germination speed, reserve methods for germination tests, percentage of germination in the field, determining the weight of 1,000 seeds, determining the water content, determination of the amount of seed in cones, test tolerance, evaluation and test report.

[2177]. 23.23.19 (46). Prats Zapirain, M. Orientaciones modernas en el ensayo de semillas forestales. [**Modern methods in testing forest seed.**] Instituto Forestal de Investigaciones y Experiencias, Madrid. 1944. pp. 84 + plates. [Span.]

A comprehensive account of modern methods of seed testing with chapters on sampling, the determination of soundness, purity, viability, and germinative characteristics. Utilization value, cutting tests, weight and moisture content are also dealt with. A project for a forest seed-testing service in Spain is outlined, and data are included on the seed of some common European species.

[2178]. 23.23.19 : 12.26–8 : 12.11.21. Barton, L. V., and Thornton, N. C. **Germination and sex population studies of *Ilex opaca* Ait.** *Contr. Boyce Thompson Inst.* 14 (9), 1947 (405–10).

Ripe berries were macerated and the seeds separated into large and small, two of each from each berry. These seeds were used for germination tests and some of the seedlings were grown to the flowering stage to determine a possible correlation between seed size and sex of the seedling. Germination tests were based on a total of 12,000 seeds, and sex determination tests on 1,255 seedlings. It was found that the small seeds possessed about one-third of the germination capacity of the large seeds. Seedling populations from both lots were mixtures of pistillate and staminate plants in the proportion of about 1 : 2, thus showing no effect of seed size on sex determination.

23.23.3. *Methods of Sowing*

[2179]. 23.23.3 (795) : 07.7 : 23.24 (76). **New reforestation methods in Northwest and South.** *Fibre Contain.* 32 (11), 1947 (76–7). P.R.

Describes and gives costs of sowing experiments in Oregon. Costs of sowing by plane are estimated at about half the cost of hand planting with seedlings, while spot sowing with a sowing gun (described and illustrated) costs a little more than plane sowing but less than hand planting. Sufficient time has not yet elapsed for definite results, but indications so far are satisfactory. In the south, where the climate is unfavourable for broadcast sowing, increased planting by hand and machine is recommended to offset forest drain by paper mills.

23.24. Formation of Stands by Planting

See also *For. Abstr.* 9 (Nos. 2192, 2194, 2201).

23.24.2. *Methods of Planting*

[2180]. 23.24.2 : 07.7. **New Pacific Northwest planting hoe.** *W. Cst. Lumberm.* 74 (12), 1947 (80). Also in *Timberman* 49 (2), 1947 (128–9).

Description, with photographs, of a standardized planting hoe developed as a result of co-operative action by private foresters, the Oregon and Washington State Forestry Departments and the U.S. Forest Service. The blade is ¼ in. thick, 3½ in. wide at the heel, 3¼ in. wide at the point, 10 in. long from point to inside of eye. The eye is rectangular and there is a reinforcing gusset between the inside of the eye and the blade. The eye is cast in

one piece with the blade, which is polished and annealed. Weight of blade is almost 4 lb.; with handle the tool weighs about 6 lb.

[2181]. 23.24.2 : 07.7 : 23.13 : 23.22.1. RUDOLPH, P. O. **Machines for forest planting.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 943 (F–2), 1947. pp. 5. [Lake States Forest Experiment Station.]

An account of a number of American tree-planting machines, including the Lake States, Wisconsin, Michigan, Minnesota and Lowther machines, with details of performance and cost; also briefer notes on ploughs and disking and scalping machines.

[2182]. 23.24.2 : 07.7. STEVENS, T. D., and BELL, L. E. **Michigan state college reforestator.** *Mechaniz. Manual Sth. Pulpwood Conserv. Ass.* No. 6, 1946. pp. 3. P.R.

Cf. *For. Abstr.* 8 (No. 240). The basic unit is a tractor-drawn standard farm-implement 'uni-carrier' attached to which are power lifts, a plough with 12-in. shares, a wedge-shaped trencher and filling irons that push the soil back into the trench and round the tree-roots. The operator's seat is placed over 2 packing wheels at the rear end of a sulky hinged to the 'uni-carrier'. In normal conditions 2 men, one driving, the other planting, can plant 10,000 seedlings in an 8-hr. day. The leaflet is illustrated.

[2183]. 23.24.2 : 07.7 (775). KOROLEFF, A. **Re 'Mechanization of forest planting'. [Quotation from a letter by F. G. Kilp.]** Pulp and Paper Research Institute of Canada, Montreal. 1948. pp. 2.

A Badger planting machine, built by the Wagler Manufacturing Co., Pewaukee, Wisconsin, enables 2 men on a Central Wisconsin woodlands operation to do work previously requiring 10–12 men. 2/2 Norway Pine stock gives the best recovery and survival; 2/2 Jack Pine stock is too large and 2/1 stock is being used. Survival on machine planting has been exceptionally high, the lowest survival figure over a 3-year period being 87 per cent. and the highest 96 per cent.

23.24.3. *Spacing*

See also *For. Abstr.* 9 (No. 2201).

[2184]. 23.24.3 : 12.25 (481) : 57 : 33.32 : 76. KLEM, G. G. **Planteavstand, produksjon og kvalitet. [Spacing, yield and quality.]** *Tidsskr. Skogbr.* 55 (8/9), 1947 (237–41). [Nor.]

Data collected by the Norwegian Forestry Research Organization from 5 Norway Spruce stands, planted at Fossum Verk, may be summarized as follows, the figures relating to initial spacings of 3·5, 2·5, 2·0, 1·5 and 1·25 m., in that order:—*Total yield* [cu.m./ha.] 435·8, 522·3, 550·7, 522·3, 575·6. *Age* (1947) 43, 43, 44, 41, 43. *Mean diameter* [cm.] 27·7, 25·0, 22·1, 18·9, 18·8. *Mean height* [m.] 20·8, 21·1, 21·2, 19·2, 19·1, 20·3. *Volume removed in thinnings* 35·1, 77·7, 146·6, 203·5, 203·1. *Residual volume* 400·7, 444·6, 404·1, 318·8, 372·5. *Taper* (1947) [cm. per m.] 1·3, 1·0, 0·9, 0·7, 0·6. *Dry weight of wood* (kg./cu.m.) 321, 353, 379, 398, 404. *Knot percentage* 0·97, 0·65, 0·75, 0·47, 0·21. *Cu.m. wood per metric ton sulphite pulp* 6·2, 5·4, 5·0, 4·8, 4·7. *Cu.m. wood per metric ton groundwood pulp* 3·1, 2·7, 2·5, 2·4, 2·35. *Pulp quality* good at the widest, very good at the closer spacings. It is noted that, although branch diameter increased with increasing spacing, the dying off of branches was practically independent of this factor within the range of spacings tried.

Calculation of comparative planting costs indicates that in stands planted at initial spacings of 1·6–2 m. the difference in cost between these and closer spacings should more than pay for the dry-pruning of 600 trees per ha. It is considered that spacings for Norway Spruce might well be increased to 1·6 or 1·7 m., or to 2 m. on suitable sites.

23.26. Plant Rearing. Nursery Practice

See also *For. Abstr.* 9 (Nos. 2073, 2077–9, 2194, 2536–8, 2579).

[2185]. 23.26 : 07.7 : 23.27. WILCOX, J. C., and SWAILES, G. E. **Uniformity of water distribution by some undertree orchard sprinklers.** *Sci. Agric.* 27 (11), 1947 (565–83). [Dominion Experimental Station, Summerland, B.C.] O.R.E.

[2186]. 23.26 : 12.25 : 23.24 (46). NAVARRO GARNICA, M. Consideraciones sobre viveros de resinosas. **[Notes on nurseries for coniferous species.]** *Montes, Madrid* 3 (16), 1947 (348–56). [Span.]

An account of nursery practice in raising Pines for reforestation in Aragon. There are two types of forest in this region: (*a*) varying from 200 to 800 m. in altitude with a maximum annual rainfall of 400 mm., (*b*) 800 m. and upwards in altitude with an annual rainfall of more than 400 mm. In (*a*), reforestation is effected by planting *Pinus halepensis* and sowing *P. pinea* and *P. pinaster*. In (*b*) *P. laricio* or *P. sylvestris* are planted. Two types of nursery are therefore maintained, for *P. halepensis* and for *P. laricio* and *P. sylvestris* respectively. When planting *P. halepensis*, one-year-old seedlings are nearly always used, though in extremely dry and difficult soils 2-year-old root-pruned seedlings are preferable. Both types of seedling are planted in threes. Seedlings of *P. sylvestris* and *P. laricio* are root-pruned and planted out in pairs at 2 years old, or even, in the case of the former, at 3 years. In favourable soil, vigorous plants of both the latter species may be planted singly.

Details of sowing practices and care of seedlings are given. In loose, light soil, flat seedbeds may give good results, but in clay soil, ridge-sowing and watering by irrigation are necessary. In the latter case, root pruning may be done *in situ*. When spring sowing is not possible, September sowing succeeds if the seedlings are at least one month old before the sap ceases to flow. Space requirements and costs of the two different methods (i.e. flat seedbeds and ridge-sowing) for both types of nursery, and the relative advantages and disadvantages, are discussed and compared.

[2187]. 23.26 : 12.26–8 (547). CHAND, K. **Unirrigated sunken bed *bela* nurseries in Gujarat soil conservation division.** *Indian For.* 73 (8), 1947 (361–2).

Unirrigated, sunken nursery beds have been laid out and sown with *Dalbergia sissoo* in *bela* closures in Gujarat. The outer and inner embankments, which serve also as inspection paths, are formed by the earth excavated from the beds. Excavation is from 9 to 18 in. according to the degree of moisture available in the soil. Each nursery consists of a number of compartments, which are ploughed and manured. The seed is sown broadcast after the winter rains and lightly harrowed in. The results are very encouraging and the cost (Rs. 600 per acre for the first establishment, including manure, and Rs. 200 per acre for subsequent sowings) is much less than that of establishing fenced and irrigated nurseries.

[2188]. 23.26 : 12.26–8 : 23.23. ENGSTROM, A. **Growing Cottonwood from seed.** *J. For.* 46 (2), 1948 (130–2).

Account of the successful raising of Cottonwood [*Populus deltoides*?] seedlings at Oklahoma State Nursery. Seed extraction is effected in a standard seed macerator; 1 bushel of catkins should produce enough seed to raise 10,000 seedlings. The seed is very small, running about 250,000 per lb. Seed should be cleaned and sown immediately after collection; seed stored 2 days will have lost much of its viability, particularly in warm weather. The seedbed is prepared, furrowed, and thoroughly irrigated before sowing, and irrigation of the furrows should continue through at least a portion of each day until the young seedlings are safely established. Seed is spread by hand on the soil between the furrows; with good seed, a density of 50–80 seeds per ft. is sufficient. Immediately after sowing, the rows are sprayed with a fine mist of water at a rate of 1 gal. of water per 100 linear ft. of row. Within 24 hours many of the seeds will have germinated, and secondary leaves appear in about 10 days. During this stage the seedlings are very tender and a heavy rain might destroy the whole crop. Initial stand density will be very high, possibly more than 50 per ft. but experience shows that this is desirable and will result in an average of 10 useable seedlings per linear ft. at digging time. Costs were no more than for any other species, and after they reach a height of 2 in. the seedlings require no special care. [Cf. *For. Abstr.* 9 (No. 2201).]

[2189]. 23.26 : 23.24.1. **Defoliation of nursery stock for storage.** *Amer. Nurserym.* 86 (9), 1947 (56–7).

Tests were made at the department of horticulture at Ohio State University with several chemicals, in order to find a suitable spray material to defoliate plants prior to digging and storage, without injury to the plants. Details of the tests are given. The results obtained to date indicate that Nacconol NR can be used safely and economically for the pre-storage defoliation of several shrubs and trees, including *Cotoneaster divaricata*, *Euonymus europaea*, *Ligustrum ibolium*, *Quercus imbricaria*, *Acer tataricum*, *Viburnum* spp. The earlier defoliation is attempted, the stronger will need

to be the concentration. No apparent injury to the plants resulted from the treatment.

[2190]. 23.26.4 : 11.47.13 : 12.26–8 : 12.11.11. NĚMEC, A. Vliv hnojení na vzrůst a výživu dubu v lesních školkách velkostatku Chlumec n/Cidl. [**The influence of fertilizing on the growth and nutrition of Pedunculate Oak in the forest nurseries of the Chlumetz a/Z. estate.**] *Repr.* from *Sborn. české Akad. zeměd.* 16 (2), 1941 (109–16). [Cz.g.]

Trial plots of 1-year-old Pedunculate Oak in 4 different nurseries were given P and K fertilizers at rates which raised the 1-per-cent.-citric-acid-soluble P_2O_5 content and the K_2O content of the soils respectively to 250 and 150 mg. per kg. soil. At the same time acidity was corrected where necessary, by applications of dolomitic limestone at theoretically calculated rates. On the soils thus brought to a comparable status in the respects mentioned, growth was better for all treated plots than for controls, the greatest difference between treated and untreated plots occurring on the initially very acid soils, where after the third growing season treatment had improved height growth by 30 per cent. and total dry weight by 42 per cent. On soils where liming was not needed, the fertilizer treatment had more effect on total dry weight, i.e. root growth, than on height growth. Data are included on chemical analyses of the stemwood of the seedlings.

23.27. Arboriculture

See also *For. Abstr.* 9 (Nos. 2100, 2136, 2185).

[2191]. 23.27 (689) : 23.21. BARNES, J. W. **Some trees, shrubs, shrubby-herbaceous plants, climbers and water plants suitable for the colony [of Southern Rhodesia.]** *Bull. Minist. Agric. Lds., S. Rhod.* No. 1391, 1947. pp. 33. *Repr.* from *Rhod. agric. J.* 44 (2), 1947 (110–41).

Replaces Bulletin No. 1267, now out of print [see *For. Abstr.* 6 (p. 159)].

23.3. *Afforestation*

See also *For. Abstr.* 9 (Nos. 2063–5).

[2192]. 23.3 (495) : 12.25 : 42.22 : 23.24.2 : 23.24.1. MOULOPOULOS, CH. **High summer temperatures and reforestation technique in hot and dry countries.** *J. For.* 45 (12), 1947 (884–93).

This report covers a study made in Attica, Greece, during the excessively hot summer of 1939, when maximum soil temperatures of 74° C. and air temperatures of 45° C. were reached. During this period new plantations of *Pinus brutia*, *P. halepensis* and *Cupressus sempervirens* sustained heavy losses, the symptoms showing that most of the injuries were caused by overheating and some by drought. The author studied the microthermic environment of these plants, which was conditioned by the local practice of planting in the centre of a hole or depression at the bottom of which are left two or three flat stones. The results of the study are given in detail. The conclusions are:—(1) In very hot, shadeless sites, planting is the only satisfactory method of reforestation with conifers. (2) The planting stock of the above-mentioned species and of *Abies cephalonica* should be 0·15–0·25 m. in height, with a conical crown not less than 0·08–0·10 m. in diameter, a stem not less than 0·4 cm. in diameter, and at least one year old. The older the plants, the more resistant they are to high soil-surface temperature, and rapid growth in the nursery is therefore not to be encouraged. (3) Plants should be planted with a lean towards the south in order to shade the soil round the root collar; this does not produce deformity later. The planting pits should not have, in the crucial xerothermic period, a depth greater than 0·08–0·10 m., or a diameter less than about 0·35 m. Planting in furrows may reduce the temperature a little. Three flat, light-coloured stones, placed at the bottom of each pit and pressed down, help to retain moisture and reduce weed growth and frost heaving. They should not exceed 3 cm. in thickness and should be at least 3–4 cm. from the plant stem and 2-3 cm. from each other. A mulch at least 3 cm. thick helps during the xerothermic period. The bottoms of planting pits should not be raked. (4) In more critical cases, where the above technique cannot prevent injury to the plants, irrigation and the use of natural or artificial shade are recommended.

[2193]. 23.3 (547) : 09.7. BATHENA, B. C. **The future of forests in the Ahmednagar district.** *Indian For.* 73 (8), 1947 (355–61).

The author first gives some account of the

topography, climate, soil, and past history of the forests of this district, which are much degraded by overgrazing, cutting and lopping, and then describes in some detail the proposed afforestation schemes and methods of the newly formed forest department.

[2194]. 23.3 (560) : 21.0 : 12.26–8 : 91.4 : 09.7 : 96.5. DAVIDSON, D. F. **A visit to Turkey.** *Emp. For. Rev.* 26 (2), 1947 (228–37).

An account of observations made in the course of a tour through some of the forest areas of Turkey, the main object being to study the new reforestation and reclamation works. Some general remarks on the activities and policy of the Turkish Department of Forests precede a brief description of the regions visited. The Eucalypt plantations on the Tarsus marshes are described in some detail. This scheme has met with considerable success, much valuable land having been reclaimed and highly remunerative plantations created. It is also claimed that malaria has been effectively eliminated. In the past, *Eucalyptus rostrata*, *E. globulus* and *E. viminalis* were all planted, but only *E. rostrata* is now favoured. Up to the autumn of 1945 some 625 ha. had been planted. The marsh is covered with a strong growth of *Phragmites*, *Juncus*, etc., which offer the greatest obstacle encountered in the work. These reeds are cut to ground level in the late summer and burnt on the spot. The area is then cultivated with tractor-drawn triple-share ploughs which turn over the surface soil to a depth of 20 cm. and work on a metre-wide strip. No harrowing is done, and planting takes place in autumn with plants spaced at 2-m. intervals. Costs for clearing, cultivating and planting total £T800 (about £115 sterling) per ha. Seedlings are raised in nursery seedbeds in early spring, and when 6 cm. high, with about 12 leaves, are pricked out in wooden boxes buried flush with the ground, which greatly reduces watering costs. The boxes, which measure 12 × 45 × 66 cm., remain in the nursery for 4–5 months until the autumn planting season, by which time the young plants are about 1½ m. high. The boxes of plants are then taken to the planting site, so that the minimum amount of exposure is given to the roots. In planting areas adjacent to abundant, flowing, fresh water, the seedlings are raised in seedbeds on the spot, irrigated with the flowing water, and remain the full 5 months in the seedbed, by which time they are 2–3 m. high and considerably etiolated; no staking is done, but top-heavy plants are stumped down to a height of 1 m. Subsequent growth, for both types of transplant, is usually spectacular; 3 m. growth in the first year is not uncommon. Regrowth of reeds in the first year is cut with a scythe. These plantations are run on a 7- to 8-year rotation as a source of pitprops for nearby mines. Cutting takes place flush with the ground, as this gives 2 or 3 strong shoots, whereas leaving a projecting stump results in an abundant growth of small, weak coppice. Wild pigs are abundant and are encouraged in the planted areas for the beneficial effect of their rooting in the top soil layer.

[2195]. 23.3 (748) : 23.21 : 12.25. BRAMBLE, W. C., and COPE, H. N. **Reforestation with certain trees succeeds on droughty, shallow soils.** *Bull. Pa. agric. Exp. Sta.* No. 480, Suppl. 2, 1947 (1–2).

Account of some of the experiments in afforesting old fields on a shallow, light soil in the Stone Valley Experimental Forest, Pennsylvania. The earliest plantings were made in 1937–38 with *Robinia pseudoacacia*, *Larix decidua*, *Pinus rigida*, *P. nigra*, *P. resinosa*, *P. sylvestris*, *P. strobus*, and *Picea abies*. To date *L. decidua* and *P. resinosa* have proved the most satisfactory of these. *R. pseudoacacia*, while getting well established, with good survival, has been badly attacked by Locust borer, a condition that seems common on poor soils. *P. rigida*, a native of the area, was uniformly browsed by deer, which seemed to prefer it to all other species. In the plantations made in 1940, *Pinus banksiana* has shown extremely rapid growth and a very high survival rate, reaching 14–15 ft. in height and 1·75 in. in diameter in 6 years. An important factor is its ability to regenerate naturally. In another planting, this species was found to have re-established itself from seed from standing trees following a fire which swept the area when the trees were only 10–15 years old. The one disadvantage of *P. banksiana* is its susceptibility to sawfly injury, and for this reason it should not be planted in large blocks. Spacing trials have shown that 6 × 6 ft. stands need thinning at 15 years.

[2196]. 23.3 (77) : 11.62.11 : 23.21 : 64. AUTEN, J. T. **Forests for old fields.** *Yearb.*

Agric. U.S. Dep. Agric. 1943–47, 1947 (473–80). O.R.E.

An account of the investigations of the Central States Forest Experiment Station into the possibility of afforesting the 10 million or so acres of abandoned fields in the Central States. Particular attention is given to the soil characteristics of abandoned fields, which are usually much compacted and have little power of absorbing water. The effect of different subsoils was investigated by a study of 145 plantations of *Robinia pseudoacacia*, the results of which are tabulated. The effect of topography was studied in 77 second-growth and old-field stands of *Liriodendron tulipifera* in the hilly area of the Central States; site index was based on aspect, exposure, and position (upper or lower part of slopes). The site-index values thus obtained and species recommended for various sites are separately tabulated.

[2197]. 23.3 (777) : 11.62.11 : 21.3 : 12.25. AIKMAN, J. M. **Response of Pine seedlings to site selection on eroded soils.** *Proc. Iowa Acad. Sci.* 52, 1945 (77–82). L.S.

A 4-year study of the response of *Pinus resinosa* planting stock to a variety of eroded soils common to the problem area in S. Iowa.

P. nigra var. *austriaca*, *P. ponderosa* and *P. strobus* were planted in the same soils for comparison, and growth in terms of height, diameter of stem and computed volume of crown was measured in successive years up to 1944. A comparative table of figures shows the superior development of *P. resinosa* on two and at least equal development on three sites as compared with the other species tried. Sites with all but 1 ft. of the B horizon eroded—the worst conditions tested—were still adequate for establishing Pine growth so long as additional water could reach the plants from surface run-off and from a C horizon of unusual percolation rate. In sites with all or part of the topsoil in place, the critical factor is competition from grass or weeds.

23.5. *Underplanting. Nurses*

See also *For. Abstr.* 9 (No. 2050).

[2198]. 23.52 : 12.26–8 : 12.25 : 22.83.1. KEATINGE, G. **Mixtures of Oak with conifers.** *Quart. J. For.* 41 (2), 1947 (82–3).

In 1916 the author planted a slope of limestone soil with pure *Thuja plicata* on the upper part where the soil was thin, and a mixture of *Thuja* and Oak lower down where the soil was deeper, the Oaks being about 15 ft. apart. Most of the Oaks came through well and are now about 40 ft. high and 5–6 in. d.b.h. It was not necessary to thin out the *Thuja* until it was 15 to 20 years old, when the thinnings sold readily. Chief advantages of *Thuja* as a nurse for Oak are that it is a comparatively slow starter, and has a pyramidal shape which cleans the lower part of the Oak while giving the crown more room.

[2199]. 23.52 : 12.26–8 (548) : 23.21 : 11.62.1. MAYNE, W. W. **Coffee planting in South India: an example of conservation agriculture in the tropics.** *Trop. Agriculture, Trin.* 24 (4/6), 1947 (54–6).

An account of the methods employed in successfully establishing and maintaining Coffee plantations in Mysore and Coorg during the last 80 years or so. The basis of the system was the insertion of the economic crop (Coffee) within the existing plant association (evergreen forest). In order to clear the land sufficiently for planting, the undergrowth was cut and allowed to decay, thus preserving the humus cover and avoiding damage to the upper storey. Only such trees were removed as were recognized to be bad for Coffee. Planting was close—never wider than 6 × 6 ft.—and disturbance of the soil by cultivation was reduced to a minimum. Shade trees were planted where there were gaps in the canopy. Trees used or tolerated as shade include indigenous species of *Albizzia*, *Dalbergia*, *Acrocarpus*, *Adenanthera* among leguminous species, and of *Ficus*, *Cedrela*, *Bischofia*, *Terminalia*, *Syzygium*, and *Artocarpus* among non-legumes. More recently, the introduction of two exotic shade species, *Erythrina lithosperma* and *Grevillea robusta*, which are easily propagated, has tended to supersede the older method of leaving a natural association of all ages, with undesirable results.

23.6. *Fencing. Hedges. Care and Inspection of Regeneration in the Initial Stages of Establishment*

[2200]. 23.6 : 45.1. REA, J. G. G. **Hedge cutting.** *Scot. Agric.* 27 (2), 1947 (101–4 + plates).

The advantages (including low cost of upkeep) of a well made cut-and-laid hedge are discussed, and the various methods of cutting and laying are described. An active man will easily cut and lay one chain of an average hedge per day, the cost of labour is the only expense entailed, and after being properly laid a hedge will not need cutting again for 12 or 14 years. Only a stone wall can compare with a good hedge as a stock-proof fence. The following general recommendations are made. Cut close to the ground and slope the layers upwards. Do not cut in spring or summer, when the sap is flowing. Do not try to economize in the use of stakes. See that cutting tools are sharp. Destroy all rabbits (this is very important). Be very careful to prevent stock or rabbits from eating the young growth from the hedge. Hedges which have been well cut and laid may be destroyed by carelessness or neglect in this respect in the 2 or 3 years following cutting.

[2201]. 23.6 : 12.26–8 (76) : 23.24.3 : 11.47.1. **[Cottonwood plantation technique.]** *Rep. Sth. For. Exp. Sta. 1946* [1947] (14–15).

Earlier work showed that Cottonwood [*Populus* sp.] plantations in the Mississippi delta must be cultivated during their first year. In 1946 the best survival and growth were obtained by a single hoeing made in May when competing vegetation was about three-fourths as tall as the Cottonwood trees. Cultivation delayed until mid-July reduced survival from 96 to 81 per cent. and the first season's height growth from 55 to 44 in. A second hoeing did not give improved results, and machine cultivation was unsatisfactory. Since hoeing is expensive, a study was undertaken to determine whether fertilizer would stimulate height growth of the trees beyond competing weeds. This indicated that an ammonium-nitrate treatment was a satisfactory substitute for hoeing. Survival was about the same as after a single hoeing and height growth was increased by 10–23 in. Two ounces of fertilizer applied to the soil surface round each cutting proved an inexpensive and suitable method of application. In individual cases, remarkable growth was made; at the end of the first growing season, one tree was more than 12 ft. high and 1·1 in. d.b.h. Observations indicate that a spacing of about 6 × 10 ft. is desirable, or 8 × 10 ft. on better sites. A spacing of 6 × 6 ft. is too close to permit trees to reach pulpwood size in time for the first thinning. Cf. *For. Abstr.* 9 (No. 2188).

[2202]. 23.61 (410). JAMES, N. D. G. **Weeding plantations.** *J. Land Agents' Soc.* 47 (1), 1948 (11–12).

Weeding costs in Britain in 1947 appear to be £4–£6 per acre for the first year after planting. Suggestions are made for reducing costs. In young plantations, Hazel rods may be put along the lines as markers and weeding confined to a 2-ft. lane; the danger that the uncut weed growth may collapse over the lines must be watched. Time and labour may be further saved by cutting small areas around individual trees sufficient to release the leading shoot. Finally, the use of some mechanical method such as the motor scythe, is considered. Fitting a 3-ft. knife will give a sufficient margin of safety for tree rows 5 ft. apart; the chief drawback is the risk of fouling old stumps, etc.

24. TENDING OF STANDS AND TREES

See also *For. Abstr.* 9 (Nos. 2155, 2157, 2256).

24.2. *Thinnings*

See also *For. Abstr* 9 (Nos. 2225, 2256).

[2203]. 24.2 : 07.2. HOLMSGAARD, E. Biografier af Træer. Forslag til Løsning af Udhugningsproblemer m.v. **['Biographies' of trees. Suggestions for the solution of thinning problems, etc.]** *Dansk Skovforen. Tidskr.* 32 (9), 1947 (257–63). [Dan.]

It is argued that since the individual tree is the unit considered when thinnings are marked, it should also be the unit when results of thinnings are interpreted. The ordinary data recorded in thinning trials take no real account of the part played by the hereditary and other characters of the individual tree in the make-up of a stand, yet such factors cannot fail to be differently affected by the different types of selection implied in the various methods of thinning. In research on thinning, detailed individual records ('biographies') ought to be kept of all or nearly all the trees (including those removed) on the trial plots. These, brought up to date at each thinning, would no doubt cost much time and money but should throw light on a whole series of problems which may otherwise remain unsolved.

[2204]. 24.2 : 12.25 : 56. HUMMEL, F. C. **The Bowmont Norway Spruce sample plots (1930–45).** *Forestry* 21 (1), 1947 (30–42 + plates).

In the Bowmont Norway Spruce plots near Kelso, laid out in 1930 when the plantation was 20 years old, each of 4 thinning treatments has been replicated 4 times. The lay-out of the plots and their development during the past 15 years are discussed. Volume production per acre to date has been greater in the more heavily thinned D- and L.C.-grade plots than in the more lightly thinned B- and C-grade plots. The average size of the 100 largest trees per acre is very much greater in the D and L.C. than in the B and C grades. Height growth has been the same under all thinning treatments. The heavier grades, and the L.C. grade in particular, have yielded not only more thinning produce but thinning produce of a larger size and hence of greater value than the lighter thinning grades. Light crown thinnings have compared not unfavourably with heavy low thinnings both in total increment and in the average size of final crop trees. *From author's summary.*

[2205]. 24.2 : 12.25. EYRE, F. H:, and ZEHNGRAFF, P. Z. **Spacing of young Red Pine.** *Sta. Pap. Lake St. For. Exp. Sta.* No. 8, 1947. pp. 6.

Report on a thinning experiment in Chippewa National Forest, the results of which confirm those of other experiments in Canada and the U.S.A. [Cf. *For. Abstr.* 7 (No. 1189); 8 (No. 1767.]

[2206]. 24.2 : 12.25. LUTHER, T. F., and COOK, D. B. **Commercial thinning in Red Pine plantations.** *J. For.* 46 (2), 1948 (110–14).

Describes the methods used in the Luther Forest near Saratoga Springs, N.Y., where there are considerable plantations of Red Pine about 20 years old, with a stocking of about 1,150 trees per acre. The forest has an excellent road system which divides it into compartments of 15–200 acres. When a compartment is to be thinned a series of secondary roads is developed, at right angles to the planting rows and about 700 ft. apart. Every 5th row of trees is then cut clear to serve as skidding lanes, which gives an entirely non-selective 20-per-cent. thinning. At the same time, another 20–25 per cent. is taken from the intervening 4 rows; here the cut is mostly of co-dominants and intermediates, leaving most of the dominants and all the small trees. The organization of thinning crews and mechanical skidding and loading are described. The method has been thoroughly tested and has proved economically sound and efficient. Its success depends on a dry, well drained, flat site, well stocked stands, and good markets for small material.

[2207]. 24.25 : 31.1 : 12.26–8. SAVINA, A. V. Vliyanie rubok ukhoda na stroenie drevesinȳ osinȳ. [**Influence of thinnings on the wood structure of Aspen.**] *Trud. vsesoyuz. nauchno-issledov. Inst. lesnogo Khoz.* 'VNIILKh' No. 2, 1939 (56–68). Translation by D. Armstrong, Information Service, Council for Scientific and Industrial Research, Melbourne. [*n.d.*] pp. 16. P.R.

Cf. *For. Abstr.* 7 (No. 221).

24.3. *Opening of the Canopy. Release and Improvement Fellings (including Poisoning and Girdling)*

See also *For. Abstr.* 9 (No. 2583).

[2208]. 24.3 : 22.83 (763). **Liberation cuttings.** *Rep. Sth. For. Exp. Sta. 1946*, [1947] (6–7). See also CLARK, S. F. **Forest enemy number two.** *Sth. Lumberm.* 175 (2201), 1947 (182–4).

Liberation cutting in young stands was undertaken in the Crossett Experimental Forest in 1939. The main object was to determine how much second-growth hardwood, growing in mixture with Loblolly and Shortleaf Pine, had to be removed to release the Pine. In three treatments, all hardwoods (1) of 6 in. d.b.h. and over, (2) of 2 in. d.b.h. and over, and (3) higher than 5 ft., were cut. Re-examination in 1946 showed that release cuttings yield excellent results and that the more hardwoods were removed, the greater was the number of Pine seedlings and the better their development. Studies of individual trees showed that Pine reproduction growing under Pine is increasing in height about twice as fast, and that in the open about 4 times as fast, as that under hardwoods.

[2209]. 24.31 : 12.26–8. PEEVY, F. A. **Control of Blackjack Oak on forest range.** *Rep. Sth. For. Exp. Sta. 1946*, [1947] (28–30).

How to kill Blackjack Oaks with ammate. Southern Forest Experiment Station. Revised, 1947. pp. 3.

For earlier reports on this study of chemical control of *Quercus marilandica* on Pine lands in the Southern Pine region, see *For. Abstr.* 4 (105), 8 (No. 558). Ammate (80 per cent. ammonium sulphamate) was the most effective and convenient chemical tested. It is not poisonous to livestock, and ammate crystals killed tree crowns as effectively as and with less subsequent sprouting from the base than sodium arsenite. It was better in all respects than the 2,4-D compounds tried. The 'cup' method of application was found to be the most effective. A 'cup' is made with two strokes of a sharp axe, about 2 in. apart, the intervening chip being removed. Frills or girdles are much less effective, as the more abundant sprouting results in a denser stand of Blackjacks than before. Recommendations for treating infested areas are as follows. For sprouts and small trees less than 1 in. d.b.h., spray the green leaves and stems with a 32·5-per-cent. water solution of ammate. Small trees, 1-4 in. d.b.h., apply 1 level tablespoonful of ammate crystals in each of 2 small cups or holes made at the base on opposite sides of the tree. Trees over 4 in. d.b.h., apply 2 level tablespoonfuls of ammate crystals per cup in cups spaced 4–6 in. apart round the base of the trees. Ammate for spraying costs $15–20 per acre, for trees 1–4 in. d.b.h. 1 c. per tree, and for trees 4–8 in., 2 c. per tree, all when ammate costs 18 c. per lb. Treated sprouts and trees should be left standing for several months for the chemical to be fully effective. Late summer or early autumn appears to be a better time than spring for poisoning with ammate. Similar treatment was effective when applied to Bitter Pecan [*Carya texana*] in the Delta.

[2210]. 24.31 : 12.26–8. Day, M. W. **The use of dinitro phenol for the control of Aspen.** *Quart. Bull. Mich. agric. Exp. Sta.* 30 (2), 1947 (241–3).

An oil solution containing dinitro ortho secondary butyl phenol is sprayed on to the trunks of sapling Aspens [*Populus tremuloides*], and within 10–30 days the cambium layer becomes discoloured, the leaves wither and the tree dies. Trees in the 0- to 3-in. d.b.h. class were completely killed; above 3 in. d.b.h. the results were less complete, and in the 5- to 6-in. class many trees were uninjured. The trees killed by this method showed no sign of sprouting in either that or the following year. Several solutions were tried. G 414, a solution supplied by the Dow Chemical Co. of Midland, Mich. gave consistently good results. The spray was prepared by adding 5 per cent. by volume of G 414 to a given volume of kerosene, which gave a concentration of 0·05 lb. of the toxicant per gal. of spray solution.

24.4. *Shelterbelts. Windbreaks*

See also *For. Abstr.* 9 (Nos. 2039, 2654, 2665).

[2211]. 24.4 (485) : 11.62.11. Petersson, G. Vindens skadegörelse på åkerjord i södra Sverige. Några förslag till stoftflyktens begränsning. [**Damage done by wind to agricultural land in Southern Sweden. Suggestions for the limitation of soil drifting.**] *Medd. LantbrHøgsk. Jordbruksförsöksanst.* No. 20, 1947. pp. 52. [Sw.sw.e.] E.M.B.

Discusses damage done by wind erosion, and, in the light of measures taken in U.S.A. and Denmark, recommends certain modifications of farming practice and the planting of hedges and shelterbelts. Plantings at the State Experimental Farm at Ugerup indicate that Hawthorn and the Service Tree are most suitable for hedges between open fields, and certain kinds of Poplar, e.g. *Populus trichocarpa* and *P. robusta*, for boundary plantings. The spacing recommended between hedges is up to 25 times the proposed height of the hedge. While conifers are not suitable for planting on exposed ground in S. Sweden, gaps in established plantings can be filled with either conifers or broadleaved trees. Brief advice is given on the planting and pruning of the recommended species and on protection against insect pests.

[2212]. 24.4 (497.2). Malčev, H. Polezaštitnite zalesitelni pojasi v Dobrudža. [**Field shelterbelts in Dobruja.**] *Gorsko Stopanstvo* 1 (1/2), 1945 (15–21). [Bulg.]

An account of land-use conditions in Dobruja, particularly the S.E. plains portion and the need for, and progress up to 1943 in, establishing shelterbelts for the benefit of farming. The Dobruja plain, which lies 50–200 m. above sea-level, has in general a harsh, extreme climate characterized by constant NE

and NW winds, a wide temperature range (– 20° C. in January to + 41° in July) and insufficient rain (Balchik, 433 mm. a year average). These conditions, combined with a lack of rivers and springs, and the almost total forest clearances effected during the period of land reforms (1925–32), have greatly handicapped agriculture, although the soil, derived from limestone formations, is deep and fertile. During this period, however, the (Rumanian) forest authorities started creating a shelterbelt system in one locality (Balchik county), to such good effect that many farmers followed suit and such 'curtains' as they are called, have become fairly widespread.

A successful example, formed in 1937 under an expert said to have Russian training, shows the following features—

Fields were first boxed in by belts of 'Acacia' [*Robinia*?] 10 m. wide, formed by nursery transplants 0·8 m. apart in rows 1·5 m. apart, the site being first tractor-ploughed, disked and rolled, and the plants put in by spade-clefting. By 1943 the trees were 4–4·5m. high. These pure 'Acacia' belts were supplemented by inner belts consisting of 'Acacia' intermixed with Privet and *Elaeagnus*, a typical belt, 11·6 m. wide, consisting of the following rows—1 Privet (0·8 m. between plants), 1 *Elaeagnus* (same plant spacing and 0·8 m. from the Privet row), 1 'Mahalebka' [*Prunus mahaleb*?] + Privet (alternating at 0·8 m., and 1 m. from the *Elaeagnus* row), 4 Acacia + Privet (alternating at 0·8 m., and 1·6 m. between rows and on both sides), 1 'Mahalebka', 1 *Elaeagnus*, 1 Privet. The *Elaeagnus* is to give density at 2–4 m. height, the Privet right down to the ground.

In other belts (*a*) *Gleditsia* has been substituted for 'Mahalebka' in the above lay-out, but grows less densely; (*b*) a row each of Privet, *Elaeagnus*, Elm and American Ash is planted on both sides of a double row of 'Canadian' Poplar, with Privet introduced in all tree rows. This mixture has not been successful, the Elm interfering with the Poplars, both suppressing the Ash, and all three suppressing the Privet. The Elm failed as a mid-height thickener for the belt owing to its remarkable growth, while the Ash appears to be quite unsuited to such mixtures and should not be used in shelterbelts, at least in this region.

The general shelterbelt plan prescribes that two sets of belts should be established, one at right angles to the prevailing (NE.) wind, but this will not be completed until results to date have been appraised. Distance between shelterbelts is at present 450–700 m. but the spacing now favoured is—E. to W. belts, 250–400 m., N. to S., 400–600 m. As regards width, the present 11–12 m. for mixed belts is considered sufficient, but in view of the ultimate necessity for regenerating them while at the same time maintaining the vital shelter they afford, a greater width and also a different composition and spacing will have to be considered.

The article concludes by stressing the great need for these belts over the whole Dobruja plain and their value in giving shelter and distributing the snowfall evenly over the fields.

[2213]. 24.4 (931) : 23.6 : 23.2. SUTHERLAND, M. **The planting of homestead shelter.** *N.Z. J. Agric.* 75 (2), 1947 (129–33, 135, 137–9). [Rural Development Division, Wellington.] O.R.E.

Gives detailed instructions for the planning and planting of shelterbelts. The necessity for protective fencing is urged and minimum distances between tree and fence for certain species are stated. The preparation of the land, methods of planting, kinds of stock and their treatment during planting are also dealt with.

[2214]. 24.4 (931) : 23.6 : 23.21. SUTHERLAND, M. **Rapid shelter from minor species of trees.** *N.Z. J. Agric.* 75 (4), 1947 (387–9, 391–3). [Rural Development Division, Wellington.] O.R.E.

For quick-growing shelterbelts of medium height or for temporary windbreaks to protect high-growing trees during early growth in New Zealand, *Phormium tenax* (New Zealand Flax), *Myoporum laetum* and *M. insulare* (Ngaio), *Cortaderia selloana* (Pampas Grass), *Arundinaria macrosperma* (Bamboo) and *Cytisus proliferus* (Tree Lucerne) are eminently suitable. Instructions are given for the propagation, planting-out and tending of these species in shelterbelts.

[2215]. 24.4 (931) : 23.6 : 23.2 : 45.11. HOPKINS, J. M. **Native bush an excellent stock shelter. Its protection [by fencing] and regeneration [by planting native trees and shrubs] well worth while.** *N.Z. J. Agric.* 75 (3), 1947 (257, 259). O.R.E.

24.5. *Pruning*

See also *For. Abstr.* 9 (No. 2079).

[2216]. 24.51. Cox, H. A. **Pruning forest trees.** *Wood* 12 (11), 1947 (315–7).

[2217]. 24.51 : 12.25. **Pruning [Longleaf Pine].** *Rep. Sth. For. Exp. Sta. 1946*, [1947] (7–8).

A study in the pruning of ½- to 3-in. d.b.h. Longleaf Pine [*Pinus palustris*] was initiated in 1937 and the results assessed in 1946. The trees which were pruned to ½ of their height made slightly less diameter and height growth than unpruned controls, but the differences were not statistically significant. Those pruned to ⅔ of their height made 6 per cent. less diameter and 5 per cent. less height growth than controls. Removal of all lateral branches, leaving only the leader, decreased diameter growth by 18 per cent. but reduced height growth by only 6 per cent. The larger the tree, the greater was the effect of removing all lateral branches, but generally speaking it is safe to prune all lateral branches on trees 10–14 ft. high, leaving only the terminal bud, without appreciably impairing growth capacity.

[2218]. 24.51 : 12.25. MOWAT, E. L. **Effect of pruning on growth of Ponderosa Pine.** *For. Res. Notes Pacif. Nthwest. For. Exp. Sta.* No. 38, 1947. pp. 4.

Various proportions (dead limbs only, ¼, ½ and ¾ of length of live crown) of the crowns of young Ponderosa Pine were pruned to study the effect upon growth, vigour and mortality. It is concluded that pruning of more than ¼ of the live crown reduces diameter growth significantly, but has little effect on height growth in the first 5 years. Removing only the lower ¼ of the live crown has a negligible effect on growth.

3. FOREST UTILIZATION. FOREST TECHNOLOGY

[2219]. 3 (213) : 35 : 98. DESCH, H. E. **Exploitation of tropical forests.** *Sth. Lumberm.* 175 (2201), 1947 (179–82).

Discusses problems connected with the exploitation of tropical forests, in view of possible competition from Russian softwoods in world markets within the next decade. A classification of the numerous species into utilization groups, mechanization of the industry and further study of fungus and insect pests are necessary. Maximum recovery and the utilization of defective wood in such fields as laminated constructions and chipboard manufacture would have to be planned. [Cf. *For. Abstr.* 7 (No. 1995); 9 (No. 2501).]

[2220]. 3 (73). HALL, J. A., and MOSLEY, T. J. **Products of American forests.** U.S. Forest Service. 1946. pp. 50. P.R.

An illustrated pamphlet, including chapters on: the importance of forest resources; wood and some of its primary uses; the products of wood conversion; seasonal crops and extractive materials; and the relative value of different forest crops.

[2221]. 3 (89). PETERSON, L. E. **Forest products of Paraguay.** *J. For.* 46 (1), 1948 (20–26).

[2222]. 3 (94) : 07.2. **Programme of work for the year 1947–48.** Division of Forest Products, Council for Scientific and Industrial Research, Melbourne. 1947. pp. 61.

[2223]. 3 : 02.5 (44) : 2 : 52. RAZOUS, P. Aide-mémoire du commerce et des industries du bois. [**Handbook of the timber trade and industries.**] Dunod, 92 Rue Bonaparte, Paris 6e. 3rd ed., 1946. pp. 252. [F.] Price 10*s.* 6*d.*

31. PROPERTIES AND ANATOMY OF WOOD. WOOD RESEARCH

[2224]. 31 : 02.1 : 33.36.1 : 33.36.3 : 33.9 : 38.2. DESCH, H. E. **Timber—its structure and properties.** Macmillan & Co. Ltd., London. Rev. ed., 1947. pp. 299 + plates. Price 18*s.*

A revision of the 1938 edition. The book opens with a study of the structure of wood and a description of hardwood and softwood tissues. Part II deals with general characters, such as sapwood, heartwood, growth rings, and compression and tension wood, and includes information on methods of identification. Density, mechanical strength, moisture content, conductivity, and thermal properties are also studied. Part IV, the largest section, comprises individual chapters on seasoning, defects, preservation, grading, and some engineering aspects. The text is illustrated by numerous plates and diagrams.

[2225]. 31 (471) : 07.2 : 33 : 12.25–8 : 24.25. YLINEN, A. **Recent results in mechanical technological wood research in Finland.** Division of Forest Products, Council for Scientific and Industrial Research, Melbourne. [*n.d.*] pp. 18. *Transl.* from *Holz Roh- u. Werkstoff* 6 (8/9), 1943 (221–30).

A résumé of work carried out at various Finnish research centres during the decade ending 1942. This includes researches on:—

(1) The influence of thinning on the structure of Pine [*P. sylvestris*] wood, with particular regard to the percentage of latewood formed at different heights in the stem, regarded as a vital criterion of timber quality. Statistical studies of the influence of this percentage on the density are presented.

(2) The laws governing swelling and shrinkage, in which the difference between radial and tangential swelling is attributed by one worker to the influence of bordered pits as well as medullary rays. Relations are deduced for the dependence of the different shrinkages on the percentage of latewood, on density and on width of annual rings.

(3) The mechanical properties of useful Finnish woods, including comparative results for wood from different localities, for 'blued' and 'unblued' Pine and for the normal 5 grades of Pine lumber, and a new method for determining the moduli of rigidity.

(4) Properties of and methods of producing Birch laminated wood.

The bibliography contains 26 references.

31.0. *General Information on Woods*

See also *For. Abstr.* 9 (Nos. 2030, 2038, 2100, 2126, 2135, 2137, 2356).

[2226]. 31.0 (51) : 31.2. YEE, C. F., HWANG, P. C., CHEN, C. L., and LO, Y. Y. **[Properties of some important woods in western Szechuan.]** *Tech. Rep. Bur. aeronaut. Res., Chengtu* No. 5, [1943?] pp. 22 + charts. [Chin.]

Detailed results, with graphs and tables, of timber tests done on *Picea asperata*, *P. brachytyla* var. *complanata*, *Abies faxoniana*, *Tsuga chinensis*, *Betula luminifera*, and *Populus cathayana*, including data of physical properties and a short account (illustrated) of their botanical characteristics.

[2227]. 31.0 (51) : 12.25 : 31.2. YEE, C. F., HWANG, P. C., CHEN, C. L., and LO, Y. Y. **[Properties of the wood of Yushan (*Picea asperata*) grown in Szechuan.]** *Tech. Rep. Bur. aeronaut. Res., Chengtu* No. 4 [1942?] pp. 29. [Chin.]

Detailed results, with graphs and tables, of timber tests done on *Picea asperata*, with comparative data for other Spruces, and a short account (illustrated) of its botanical characteristics.

[2228]. 31.0 (51) : 12.29 : 31.2. YEE, C. F., and SHEN, L. G. **[Properties of Nanchu (*Phyllostachys edulis*) grown in Szechuan.]** *Tech. Rep. Bur. aeronaut. Res., Chengtu* No. 10 [1944?] pp. 40. [Chin.]

Detailed results, with graphs and tables, of tests done on culm sections of *Phyllostachys edulis*, with comparative data for other material suitable for aircraft structures.

[2229]. 31.0 (911). KEITH, H. G. **The timbers of North Borneo.** *N. Borneo For. Rec.* No. 3, 1947. pp. ii + 104.

This bulletin is intended to replace the now obsolete and out-of-print Bulletin No. 1. It is in three sections as follows: (1) general description of the forest (6 pp.); (2) commercial (export) timbers, including information on trade and vernacular names, mechanical properties, allowable working stresses, and minor products of the tree (57 pp.); (3) timbers used locally or exported only to a small extent (68 pp.). There is a 5-page bibliography.

[2230]. 31.0 (914) : 09.7. FISCHER, A. F. Richesses forestières des îles Philippines. **[Forest resources of the Philippines.]** *Rev. int. Bois* 14 (124), 1947 (178–84).

Includes notes on 33 of the principal commercial species.

[2231]. 31.0 : 12.26–8 (66 : 67) : 21. Assié-sipo. [***Entandrophragma utile.***]; Ozigo [***Pachylobus büttneri* and *P. edulis.***] *Bois For. Trop.* No. 3, 1947 (39–42, 43–6). [F.]

[2232]. 31.0 : 12.26–8 (675) : 21 : 12.19. LOUIS, J., and FOUARGE, J. Essences forestières et bois du Congo. Fascicule 4. *Entandrophragma palustre.* **[Forest tree species and timbers of the Congo. Fascicle 4. *Entandrophragma palustre.*]** Institut National pour l'Étude Agronomique du Congo Belge, Bruxelles. 1947. pp. 75 + plates.

A detailed study, including botanical description, habitat, ecology, phenology, distribution, vernacular names, silviculture, wood characteristics and properties, susceptibility to borer attack, and uses; also notes on the genus as a whole and the use of the term 'Mahogany', and a bibliography. [Cf. *For. Abstr.* 7 (No. 669).]

[2233]. 31.0 : 12.26–8 (729.3). STOVALL, R. P. **Mahogany [*Swietenia mahagoni*] of Santo Domingo.** *Agric. in Americas* 7 (8/9), 1947 (107–8). A.P.B.

[2234]. 31.0 : 12.26–8. DESCH, H. E. **The Mahoganies [Meliaceae]. The Teaks [*Tectona grandis, Baikiaea plurijuga, Dipterocarpus* spp., *Intsia* sp., *Chlorophora excelsa*]. The Walnuts [*Juglans regia, Lovoa klaineana, Endiandra palmerstonii, Dracontomelum* sp., *Albizzia lebbek, Phoebe porosa, Cordia goeldiana, Liquidambar styraciflua.*]** *Wood* (10–12), 1947 (288–90; 323–5; 358–60).

[2235]. 33.8 : 31.0 : 12.26–8. **Some substitutes for Walnut.** *Woodwkg. Industr.* 4 (11), 1947 (801–3). P.R.

Describes the properties and working qualities of N. and S. American, African, Indian and Australian timbers suitable for use in place of Walnut for gunstocks and furniture.

[2236]. 31.0 : 12.26–8 : 33.12. **Some substitute timbers for Beech, Birch and**

Sycamore—possibilities of Lime for turnery work. *Woodwkg. Industr.* 4 (12), 1947 (881–3). P.R.

A brief description is given of the following timbers, considered suitable substitutes in joinery and turnery:—*Beilschmiedia tawa*, *Nothofagus* spp., *Ceratopetalum apetalum*, *Drimys winteri*, *Scottellia coriacea*, *Sarcocephalus diderrichii*, *Cassipourea elliottii*, *Markhamia platycalyx*, *Symphonia globulifera*, *Persea lingue*, *Weinmannia* sp.

[2237]. 31.0 : 12.26–8. **Specimen woods, Nos. 142 : Owewe (*Combretodendron africanum*); 143 : Kakuballi (*Goupia glabra*); 144: Locust (*Hymenaea courbaril*); 145 : Weli-penna (*Anisophyllea cinnamomoides*).** *Suppls.* to *Wood* 12 (10–12), 1947 (283–4; 313–14; 347–8); 13 (1), 1948 (17–18).

[2238]. 31.0 : 12.26–8. **Foreign woods, origin, use, properties and nomenclature.** *Wood Prod.* 52 (9;11), 1947 (22;20).

Bursera spp., *Terminalia superba*, *Afzelia africana*, *Gossweilerodendron balsamiferum*, *Hura* spp., *Enterolobium* spp., *Platymiscium* spp.

[2239]. 31.0 : 12.26–8. NORMAND, D. Monographies des bois commerciaux. Le limbo. [**Monographs on commercial woods. Afara** [*Terminalia superba*].] *Rev. Bois Appl.* 2 (5), 1947 (3–6). P.R.

[2240]. 31.0 : 12.26–8. CARNEIRO, J. G. A casuarina. [**Casuarina.**] *Brasil madeireiro* 2 (18), 1946 (15). [Port.]

[2241]. 31.0 : 12.26–8 (729) : 12.19. STEHLÉ, E. Notes taxonomiques, xylologiques et géographiques sur les châtaigniers du genre *Sloanea* des Petites Antilles. [**Notes on taxonomy, wood technology, and geographical distribution of *Sloanea* in the Lesser Antilles.**] *Carib. For.* 8 (4), 1947 (301–21). [F.E.Span.]

Deals with *Sloanea caribaea*, *S. massoni*, *S. sinemarensis*, *S. berteriana*, *S. dussii*.

[2242]. 31.0 : 12.26–8. **Properties of Australian timbers. Queensland Maple. [*Flindersia brayleyana* and *F. pimenteliana*.]** *For. Prod. News Lett. C.S.I.R. Aust.* No. 156, 1947 (4).

31.1. *Structure. Anatomy. Identification*

See also *For. Abstr.* 9 (Nos. 2207, 2225, 2254, 2276).

[2243]. 31.1. WARDROP, A. B., and PRESTON, R. D. **Organization of the cell walls of tracheids and wood fibres.** *Nature, Lond.* 160 (4078), 1947 (911–13).

The orientation of micelles in the wall layers of tracheids and wood fibres was examined through a series of bi-refringence studies of a transverse section of a cell, using a series of sections cut from a piece of wood at increasing angles to the grain. The micelles in the outer layers of tracheids and fibres appear to form a spiral slower than that of the thicker layer within, but considerable angular dispersion about this mean direction also occurs in both outer and inner layers.

[2244]. 31.1 : 31.8 : 12.26–8. PRESTON, R. D. **The fine structure of the fibres of normal and tension wood in Beech (*Fagus sylvatica* L.) as revealed by X-rays.** *Forestry* 21 (1), 1947 (92–8 + plates).

A series of X-ray diagrams is presented of normal wood and tension wood in Beech, of specimens identical with those used by Chow [see *For. Abstr.* 9 (No. 290)]. From these diagrams it is shown that the cellulose chains in the walls of the fibres in tension wood are oriented more nearly parallel to the length of the fibres, and therefore the grain, than they are in the corresponding normal wood. It is suggested that a number of the differences in properties of normal and tension wood in this species, and in particular the difference in longitudinal shrinkage, are in some part due to this difference in molecular structure. *From author's summary.*

[2245]. 31.1 : 31.8 : 31.22.2. **Wood structure.** *Rep. For. Prod. Aust. 1946–47*, 1947 (4–11).

Work of the wood-structure department of the Division of Forest Products included investigations of the micellar angle by a study of the various layers of the cell wall, as follows:– (1) The microscopic appearance of the fibre and tracheid walls after crushing; (2) the behaviour of cross sections when viewed by means of the ultra-microscope; (3) the comparative dichroism and (4) the comparative bi-refringence, of various cell types. It is thought

that the outer layer of the secondary cell wall may be markedly different in texture from the middle. The different behaviour of the outer layer from that of the middle layer has been further investigated by means of bi-refringence studies.

No significant difference was found in the longitudinal shrinkage of tension-wood and normal fibres, or in that of compression-wood and normal tracheids. It was also concluded that there is no direct relationship between micellar angle and the longitudinal shrinkage of the fibres after removal of water. Measurements showed that the micellar angle of the compression-wood tracheids was on the average much higher in relation to the longitudinal fibre axis than that of normal tracheids taken from the same relative position in the growth ring. [Cf. *For. Abstr.* 7 (No. 1821).]

X-ray diffraction patterns of tension and compression wood were obtained and compared with those of normal wood. The tension-wood pattern showed high micellar orientation and this was correlated with the thick inner layer of the secondary wall which is practically pure cellulose. Further experiments have been made in co-operation with the Commonwealth Forestry and Timber Bureau on the development of tension wood in young saplings. Tension wood developed in 16 days and, in some cases, in 12 days, in young stems of *Eucalyptus melliodora* pulled from the vertical. [Cf. *For. Abstr.* 7 (No. 1821).]

The growth of *Eucalyptus regnans*, as represented by increase in woody tissue, seems to be continuous throughout the year, although not at a uniform rate. Similar results were obtained with *E. gigantea*, except for definite indications of the formation of so-called latewood just before the beginning of the spring growth. With *Pinus radiata* and *P. ponderosa*, latewood begins to form usually at the end of May, sometimes at the end of June, and is laid down continuously until the early part of August. The next season's early wood begins in late August or early September. There is little or no resting period.

A survey was made of about 40 Eucalypt species in an attempt to find a reliable method of distinguishing sapwood from heartwood in species where the heartwood is not coloured and the vessels are not commonly plugged by tyloses. It was found that with woods containing tannins of the 'depside' group, sodium nitrite gives a pink colour, which changes to blue on exposure to the air, and that this stain can be used to test for heartwood in such woods. Heartwood forms very early in some species of *Eucalyptus*, and studies of its formation are being undertaken. Investigations are also current on *Argyrodendron*, and a new aspect of the investigation is developing through the study of branch material.

[2246]. 31.1 : 12.25–8 (8). SCHULTZ, A. R. Ensaio de um método cromatoscópico de identificação de madeiras. [**Experiments in a method of identifying woods by colour reactions.**] *Publ. Inst. tecnol. Rio Grande do Sul* No. 1, 1945. pp. 67. [Port.]

The author made experiments to determine the colour reaction of 57 South American woods with 19 chemical substances in order to provide a means of identification. Chemicals tried, singly or in combination, were:—concentrated and dilute hydrochloric, nitric, and sulphuric acids, chloroform, acetic anhydride, sodium carbonate, sodium hydroxide, copper sulphate, ferric chlorate, ammonium hydroxide, barium hydroxide, potassium bichromate, sodium nitrite. Results are listed, and a key to aid identification and an alphabetical list of species and their colour reactions are included.

[2247]. 31.1 : 31.21.3. BECKING, L. G. M. B., and WALENKAMP, J. **Contact prints of wood.** *Repr.* from *Proc. ned. Akad. Wet.* 45 (2), 1942 (142–3 + plate). X.

Describes a simple method of obtaining a permanent record of the characteristics of wood excavated in various stages of preservation. Although promising results have been obtained from tangential and radial sections, the process has not been fully worked out for these.

Freshly planed cross sections were dried for 3–4 days, after which a hand lens showed differences in relief due to shrinkage of the wood-parenchyma and medullary-ray cells. Similar planed sections soaked in boiling water for 15–20 minutes showed a differentiated surface in many respects a counter-mould of the first cross-section. Prints were made of both types by inking the surface, covering it with a suitable paper and tapping the upper side of the paper with a felt-covered hammer. Good results were obtained with Oak (*Quercus sessiliflora*), Elm, and Ash, both excavated and recent, also with various genera of conifers, in

which the more resinous latewood allowed a counter-stain to be used, yielding two-colour prints.

[2248]. 31.1 : 12.26–8. CORTES, R. T., and HAMBANANDA, P. **Fiber length of Anilau (*Columbia serratifolia*), Hinlaumo (*Mallotus ricinioides*) and Kupang (*Parkia javanica*).** *Philipp. J. For.* 5 (1), 1947 (50–70).

The fibre lengths of these three species increase in length from the pith towards the bark and from the top towards the butt. In any given species, the longer fibres are found in the larger trees. The measurements made in the course of the investigation are given in full.

31.2. *Physical Properties*

See also *For. Abstr.* 9 (Nos. 2225–8).

[2249]. 31.2 : 11.15. TIEMANN, H. D. **Residual luminescence of wood.** *Sth. Lumberm.* 175 (2201), 1947 (278, 280).

Sections of various kinds of wood and other materials were exposed to sunlight for several hours and then laid upon the sensitive side of various photographic plates in total darkness. Care was taken that no image could be caused by direct contact. Results showed plainly that wood luminesces for some time (at least two weeks in the dark) after exposure to sunlight. The nature of the radiation is not known. In the case of one section of freshly sawn Pine, a photographic effect was obtained without exposure to sunlight. In Chestnut and Pine, springwood was more luminescent; in Hemlock and Black Locust, summerwood. The extremely resinous portion of Pine was brightest; lignin powder showed brilliantly; purely cellulosic substances gave no result. Panchromatic plates were not as sensitive as ordinary commercial plates to this radiation. Sapwood of Lignumvitae and Poplar showed up more strongly than heartwood, but this does not apply to Pine nor to many other kinds of wood. Results of experiments with other substances are also given.

31.21. Figure

[2250]. 31.21.3. BAILEY, L. F. **Figured wood: a study of methods of production.** *J. For.* 46 (2), 1948 (119–25). [T.V.A., Forestry Relations Dept., Norris, Tennessee.]

The author briefly reviews previous work on the causes and possibility of producing figured grain in wood and then describes an experiment in figure production, (*a*) by vegetative propagation of figured trees, and (*b*) by maltreatment of normal seedlings. Propagation trials with 8 figured trees resulted in the production of 17 vegetative progeny from one curly Red Maple, one curly Black Walnut and two blister Yellow Poplars. The young stems of these show no signs of unusual wood structure. Normal seedlings of Red Maple, Yellow Birch and Yellow Poplar subjected to severe constriction, cutting, pounding, puncturing, and bending are markedly disfigured but the abnormalities now evident may not be permanent as wood figure. Final determination of the occurrence of figure in the wood of these grafted and treated trees cannot be made until second year's growth has been added. *From author's summary.*

31.22. Relation to Water, Air, Gases

See also *For. Abstr.* 9 (Nos. 2225, 2245, 2261, 2339, 2422, 2434).

[2251]. 31.22.1 : 07.7. DUNLAP, M. E., and BELL, E. R. **Electrical moisture meters for wood.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1660, 1947. pp. 10 + tbls. + plates. P.R.

Discusses the principle and operation of the resistance, capacity, and radio-frequency power-loss types of electrical moisture meter and the factors affecting their accuracy, considers the use and maintenance of such meters and includes a list of American makers and dealers. A table gives the average electrical resistance of 29 commonly used species at different values of moisture content.

[2252]. 31.22.1 : 07.7 : 31.21.4 : 33.36.1 : 33.31. **Effects of wood preservatives on electrical moisture-meter readings.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1682, 1947. pp. 7 + 2 plates + 5 gphs. P.R.

Describes and tabulates the results of moisture-content tests using specimens treated with preservatives and an electrical-resistance and a radio-frequency power-loss type of meter. The preservatives used were Wolman Tanalith and Erdalith salts and chromated zinc chloride, which all increased the electrical conductivity

of the wood; and creosote, which appeared to decrease it. The effect of the preservatives increases with the moisture content, and readings are only reliable at moisture contents below those common to preservation operations. Readings with the resistance-type meter were more accurate than with the power-loss type.

[2253]. 31.22.1 : 33.4 : 33.12 : 33.52. THUNELL, B. Fuktvariationer i byggnadselement av trä. [**Moisture variations in timber building elements.**] *Medd. svenska TräforsknInst.* (*Träkem. PappTekn.*) No. 11, 1947. pp. 6. [Sw.sw.] P.R.

Records graphically and discusses the variations in moisture of wood under different working conditions (including structural timber in houses, furniture, and sleepers stored under cover and submitted to graveyard tests) recorded over a period of 2 years. Graphs showing the average 2-monthly temperature and moisture of the air for the period are also given. Conclusions drawn are:—that the moisture variations are related to the season of the year and with certain modifications are repeated from year to year; that surface treatment (painting or varnishing) may reduce moisture variations to some extent; and that there seems to be no substantial difference between the commonest species of wood as regards variation in moisture content.

[2254]. 31.22.2 : 31.1. COCKRELL, R. A. **Explanation of longitudinal shrinkage of wood based on interconnected chain-molecule concept of cell-wall structure.** *Trans. Amer. Soc. mech. Engrs.* 69 (8), 1947 (931–5). P.R.

Demonstrates that the following four factors exert a significant influence on the longitudinal-shrinkage/moisture-content relationship of wood: (*a*) the interconnexion of chain molecules; (*b*) fibril angle; (*c*) the cellulose chain-molecule length; (*d*) the microcapillary width. Gives a mathematical demonstration to check the validity of the shrinkage theory advanced. *Author's summary.*

31.23. Weight. Specific Gravity

See also *For. Abstr.* 9 (Nos. 2225, 2276).

[2255]. 31.23 : 12.26–8 (914). FAUSTINO, D. G. **Variation of the specific gravity of Bagtikan (*Parashorea plicata*) from nine provinces of the Philippines.** *Philipp. J. For.* 5 (1), 1947 (7–21 + maps).

[2256]. 31.23 : 24 : 31.8 : 31.27. PAUL, B. H. **Better timber from farms.** *Yearb. Agric. U.S. Dep. Agric. 1943–47*, 1947 (455–60). O.R.E.

An account of the variations in specific gravity of wood according to silvicultural conditions [cf. *For. Abstr.* 8 (No. 2470)]. Studies made on White Ash [*Fraxinus americana*], in an unthinned stand 60 years old, showed a reduction of more than 25 per cent. in the specific gravity of the wood from the heart outward for some trees, and an average reduction of 18 per cent. for the whole stand. In another crowded stand of White Ash, the specific gravity averaged 11 per cent. lower for the last 15–30 years than for the first 30 years of the life of the trees. In well and early thinned stands of the same species, wood was uniformly high in specific gravity and of better quality for handle stock. Hickory responded in the same way. Second-growth Hickory had better strength than old-growth Hickory because it had had less competition and grown more rapidly. Open-grown Sugar Maple, averaging only 7 rings to an inch compared with 22 rings in old-growth, produced wood averaging 0·77 in specific gravity as against 0·68. The effect of spacing and growth rate on the quality of wood of Southern Yellow Pine is also dealt with.

31.27. Mechanical Strength

See also *For. Abstr.* 9 (Nos. 2225, 2365–6, 2369, 2375, 2454–5, 2506–07, 2512–14).

[2257]. 31.27 : 12.25–8 (54). LIMAYE, V. D. **Safe working stresses for Indian timbers.** *Indian For. Rec.* (*n.s.*) *Utilization* 4 (1), 1946. pp. [i] + 31.

Safe working stresses of over 140 common Indian timbers have been prepared by the Dehra Dun Forest Research Institute and are here set out. Methods of calculation are described and safety factors given for inside, outside and wet locations. Suggestions are made for the establishment of 3 grades of structural timbers. *From author's summary.*

[2258]. 31.27 : 12.25 (931). [**Strength properties of *Pinus taeda***]. *Rep. N.Z. For. Serv. 1946–47*, 1947 (36).

Tests made on air-dried material of 30-year-old *Pinus taeda* of New Zealand origin disclosed that the variation of strength properties with height in tree is less than with *P. radiata* of similar age. Green values for some properties of the two species are compared.

[2259]. 31.27 : 12.26–8. BROTERO, F. A. Dados experimentais do freijó. [**Experimental data on Freijo.**] *Bol. Inst. Pesqu. tech. S. Paulo* No. 29, 1941 (9–16 + plates). [Port.] P.R.

An account of strength tests on *Cordia goeldiana*, tabulating values for compressive and tensile strength and for resistance to impact. [Cf. *For. Abstr.* 7 (No. 249).]

[2260]. 31.27 : 33.15.2 : 33.8. ANDERSSON, B., and BERGQVIST, B. Teori för elastika egenskaper hos ortotropa plattor, belastede av kraftsystem i plattans plan, jämte tillämpning på kryssfaner av björk. [**Theory of the elastic properties of orthotropic sheets, stressed by force systems in their own plane. Application to Birch plywood.**] *Medd. flygtekn. Försöksanst.* No. 12, 1945. pp. 94. [Sw.sw.e.] P.R.

[2261]. 31.27 : 33.4 : 31.22.1. [**Timber physics and mechanics.**] *Rep. For. Prod. Aust. 1946–47*, 1947 (19–20, 24–6).

Tests on creep in initially green beams were carried out on 36 specimens. Five which were loaded to an extreme fibre stress of 4,000 lb./sq. in., failed. In beams stressed to 2,000 lb./sq. in. the deflection increased fivefold in one year. In those stressed to 4,000 lb./sq. in. it was even greater. Indications that the elastic modulus is unaltered by prolonged loading are now fairly conclusive. The effect of temperature on the rate of increase of deflection is very marked.

Studies on the variation of impact bending strengths with moisture contents between 0 and 20 per cent., have shown that the impact strengths frequently have a minimum value round about the equilibrium moisture content.

[2262]. 31.27 : 33.8 : 12.25. HEINTZELMANN, F., and HECK, S. O. Berechnungsgrundlagen für Holz im Flugzeugbau-Kiefer. [**Principles of calculating strength of Pine wood for aircraft construction.**] Focke-Wulf Flugzeugbau G.m.b.H., Bad Eilsen. 1943. pp. 51. [G.] *Bibliogr. sci. industr. Rep.* 5 (8), 1947 (672). D.S.I.R.

Contains formulae, stress–strain curves and other data for calculating the strength of Pine wood used in the construction of aircraft, such as night-fighter Ta. 154. Plywood, the strength of glued joints, and the effect of moisture and temperature are discussed.

31.3. *Chemical Properties*

See also *For. Abstr.* 9 (Nos. 2277, 2283, 2392).

[2263]. 31.3 : 01.4 : 12.26–8. WATSON, A. J. **The preparation of a wood sample for chemical analysis.** *J. Coun. sci. industr. Res. Aust.* 20 (2), 1947 (289–96). O.R.H.

Investigations were carried out on 6 different Eucalypt woods to ascertain whether differences existed between 60–80-mesh samples (i.e. material passing a 60-mesh screen but retained on an 80-mesh screen) and 60-mesh samples (i.e. material passing a 60-mesh screen) for each species, and whether there was any method of correlating values obtained from samples of different particle size.

It was established that differences did exist between the 60–80- and the 60-mesh samples, such differences being consistent with the loss of extraneous material from the 60–80 sample. In addition to these losses the greater ease of extraction of the finely ground material in the 60- sample gives rise to marked differences in the values obtained for the 60–80- and the 60- samples in determinations such as hot-water solubility and alkali solubility. As no constant ratio existed between the values obtained for the two samples for those determinations which are considered independent of particle size, it was not possible to establish any relationship between them.

It would appear that the 60-mesh sample is satisfactory for the analysis of Eucalypts, if due care is taken when preparing the sample. *From author's summary.*

[2264]. 31.3 : 12.25. BRAUNS, F. E., and YIRAK, J. J. **The decomposition of methylated Sprucewood.** *Paper Tr. J.* 125 (12), 1947 (55–60). P.R.

[2265]. 31.3 : 12.25. **Chemical analysis of Western Larch produced numerous useful products.** *Rep. Nth. Rocky Mt. For. Range Exp. Sta.* 1946 (16–17).

Western Larch (*Larix occidentalis*) differs

from the other conifers in its very high percentage of galactose sugar, the highest concentrations being found in the butt. The galactose content in wood from butts, topwood, slabs, and suppressed and intermediate trees was determined. About 20 per cent. of the dry weight of buttwood is galactose, compared with 12 per cent. in wood from the top and limbs. Suppressed trees yield only 7½ per cent. of their dry weight in galactose. Results of studies to date indicate that the following products are obtainable from one cord of buttwood:—Lignin, 1,050 lb.; mucic acid, 400 lb.; ethyl alcohol, 75 gal.; fodder yeast, 90 lb.; gypsum, 320 lb.

[2266]. 31.3. RITCHIE, P. F., and PURVES, C. B. **Periodate lignins: their preparation and properties.** *Pulp Paper Mag. Can.* 48 (12), 1947 (74–82).

Describes a new laboratory-scale isolation of lignin, involving the oxidation of the extractive-free wood meal with aqueous 5-per-cent. sodium paraperiodate, $Na_3H_2IO_6$ at pH 4 and 20° C., alternated with extraction of the oxidized carbohydrates in boiling water near pH 7. Five or six of these oxidation-extraction cycles left 'periodate' lignin as a golden-brown powder retaining much morphological structure and insoluble in all neutral solvents tried. Periodate lignins offer promise for fundamental studies on the nature of lignin *in situ*, especially when carbohydrate residues derived from the original wood might complicate the work. *From authors' summary.*

[2267]. 31.3 : 12.25. RITTER, D. M., PENNINGTON, D. E., OLLEMAN, E. D., WRIGHT, K. A., and EVANS, T. F. **Constitution of gymnosperm lignin.** *Science* 107 (2766), 1948 (20–2). [Pulp Mills Research Project, University of Washington, Seattle.] O.R.S.

[2268]. 31.3 : 12.26–8 : 33.3 : 31.8. [**Lignin extraction.**] *Rep. For. Prod. Aust. 1946–47*, 1947 (11–13, 15).

Methanol extraction at 150° C. of *Eucalyptus regnans* sawdust on a 1-kg. scale was successfully undertaken by the Division of Forest Products, and a yield of approximately two-thirds of the lignin present was obtained. The nature of the process and the precipitation of the methanol-extracted lignins is described. Indirect evidence has pointed to the existence of a lignin/carbohydrate complex in which about one-half of the total wood lignin is involved. The polyuronide constituent of the complex has been isolated from the final methanol-extraction residue and is under investigation. [Cf. *For. Abstr.* 7 (No. 1815).]

Tension wood of this species contained more cellulose, less pentosan and less lignin than corresponding normal wood. [Cf. *For. Abstr.* 9 (Nos. 2244–5).]

[2269]. 31.3 : 12.26–8. BRIMS, B. **Molecular weight distribution curves of various holocellulose fractions.** *Repr.* from *J. Coun. sci. industr. Res. Aust.* 20 (2), 1947 (276–88).

Describes the preparation of 4 residual fractions from *Eucalyptus regnans* holocellulose by the use of boiling water and sodium-hydroxide solutions of 3 different strengths. The molecular-weight distribution curves for the holocellulose and its fractions are presented and discussed. *From author's summary.*

31.4. *Durability. Decomposition*

31.41. Natural Durability

[2270]. 31.41 : 12.25 : 33.54 : 32.24. COLLEARY, M. J. **The durability of Jack Pine saplings as affected by season of cutting and subsequent conditioning and by different types of soil.** *Mimeo. For. Prod. Lab., Can.* No. 118, 1946. pp. 15.

Experiments showed that with saplings improperly handled (left lying in the bush) the autumn cut was more durable than the summer and the summer than the spring, while with saplings properly handled (kiln-dried) the spring and summer cuts were more durable than the autumn. However, since in ordinary conditions timber cannot be handled as quickly after cutting as in these tests, the accepted practice of autumn or winter cutting is still recommended. The average life of 2 groups of freshly cut, peeled saplings set up on a heavy clay and a loamy well drained soil was 3·37 and 2·77 years respectively.

[2271]. 31.41 : 12.26–8 (728 : 86). SCHEFFER, C., and DUNCAN, C. G. **The decay resistance of certain Central American and Ecuadorian woods.** *Trop. Woods* No. 92, 1947 (1–24).

Tests were made of the decay resistance of 41 species of wood from Costa Rica, Panama

and Ecuador. With respect to the heartwood (or inner wood where there was no visible distinction between heartwood and sapwood), about 25–33 per cent. of these species appeared to warrant classification as very durable, and an equal proportion as durable. Local reputations for durability generally agreed with the test results. Radial variability in decay resistance was rather pronounced in 16 species. The sapwood, or outermost wood, of 9 of the species was sufficiently high in decay resistance to be classified as durable. *From authors' summary.*

31.42. Attack by Plant Organisms

See also *For. Abstr.* 9
(Nos. 2421, 2509, 2534, 2543).

[2272]. 31.42 : 07.2 : 33.36.1. LEUTRITZ, J. **A wood-soil contact culture technique for laboratory study of wood-destroying fungi, wood decay and wood preservation.** *Repr.* from *Bell Syst. tech. J.* 25 (1), 1946 (102–35). P.R.

[2273]. 31.42 : 11.17 : 12.21 : 44.3. RENNERFELT, E. Några undersökningar över luftens halt av svampsporer. [**Some investigations on the fungus spore content of the air.**] *Repr.* from *Svensk bot. Tidskr.* 41 (2), 1947 (283–94). [Sw.e.] X.

Data from fortnightly exposures of Petri dishes throughout 1946 at Experimentalfältet, near Stockholm, are tabulated to show numbers of spores caught per hour and square decimeter. Of the colonies developing in the dishes, 51·5 per cent. were bluestain fungi, 19·9 per cent. moulds and 28·6 per cent. yeasts. Maximum spore numbers occurred in July–September. *Cladosporium herbarum* was the commonest and *Pullularia pullulans* the next commonest species. Of the moulds and yeasts, *Penicillium*, *Torulopsis*, and *Rhodotorula* spp. were the most frequent.

Similar samples taken during the summer only, at a log pile in the forest near Siljanfors, also showed maximum spore numbers in July–September, with bluestains the most abundant, though in September spores of the yeasts were commonest.

Concurrently with the outdoor experiments at Experimentalfältet, samples were taken of the spore contents of air in a room at the Forest Research Institute. Here spores were considerably fewer than in the open, and *Penicillium* spp. predominated.

[2274]. 31.42.1 (410) : 33.26 : 32 : 33.32 : 33.15.3 : 44.3 : 12.11.1 : 12.21. CARTWRIGHT, K. ST. G., and FINDLAY, W. P. K. **Decay of timber and its preservation.** H.M. Stationery Office, London. 1946 [1947]. pp. 294 + 49 plates. Price 12*s.* 6*d.* [Forest Products Research Laboratory, Princes Risborough, Aylesbury, Bucks.]

A comprehensive survey comprising chapters on: causes of decay; technique (of examination of infected wood, and preparation and identification of cultures), physiology of wood-destroying fungi; effects of fungal decay on wood; the principal decays of standing trees in Great Britain; rots of felled timber and of timber in service in the open; rots of timber in buildings and structures; prevention of decay in felled and converted timber during storage and shipment; decay of timber in buildings, mines, vehicles, aircraft, ships and boats, sleepers, poles, fencing, and in horticultural use; deterioration of composite wood and manufactured wood products; natural durability of timber; preservation of wood by chemicals; staining and discoloration of timber; followed by an appendix giving the British Standard method of test for the toxicity of wood preservatives to fungi.

[2275]. 31.42.1 : 33.36.1 : 38.2. HARTLEY, C. **Fungi in forest products.** *Yearb. Agric. U.S. Dep. Agric. 1943–47*, 1947 (883–9). O.R.E.

An account of war-time advances in knowledge of sapstain and decay in wood in service, the avoidance of damage by careful selection of wood, paint and surface application of fungicides, and prevention of decay in non-basement houses by building on a foundation of asphalt-impregnated felt.

[2276]. 31.42.11 : 12.25 : 31.1 : 31.23 : 31.41. BJÖRKMAN, E. Om röthardigheten hos lärkvirke. [**The rot resistance of Larch wood.**] *Norrlands SkogsvFörb. Tidskr.* 1944 (1), (18–45). [Sw.e.]

Describes laboratory tests on wood of *Larix decidua*, *L. leptolepis* and *L. sibirica*, with parallel tests on that of *Pinus sylvestris*, *Picea abies* and *Betula verrucosa* for comparison. The woods were exposed for 4 months at 22° C. to attack by 17 different wood-destroying fungi common in Sweden.

Larch wood of high specific gravity, with narrow rings and a greater percentage of late

than of early wood, was on the whole more rot-resistant than fast-grown wood, at least so far as the heartwood was concerned. This difference is ascribed to the greater difficulty experienced by the fungi in penetrating denser wood.

Heartwood of Larch was considerably more resistant than that of Spruce and Birch, but only slightly, if at all, more so than that of Pine.

No noteworthy difference in resistance was found between the woods of the 3 Larch species tested.

As some important fungi, e.g. *Lentinus lepideus*, *Trametes serialis*, *T. trabea* and *Polyporus pinicola*, apparently attacked heartwood and sapwood with equal ease, and as it is not possible to impregnate the heartwood, it would be better to abandon the use of Larch, for purposes where rot resistance is required, in favour of some wood that is easily impregnated, e.g. Pine sapwood. Where moisture is too high for much risk of fungus attack, e.g. in piling, untreated Larch will no doubt continue to be valued for its strength.

English translations are given of table headings, etc.

[2277]. 31.42.11 : 12.25 : 31.3. RENNERFELT, E. Några undersökningar över olika rötsvampars förmåga att angripa splint- och kärnved hos tall. **[Some investigations on the capacity of various decay fungi to attack sapwood and heartwood of Scots Pine.]** *Medd. SkogsforsknInst., Stockh.* 36 (9), 1947. pp. 24. [Sw.e.]

Samples of Scots Pine, representing trees aged 34–246 years, varying considerably in ring breadth and density, and derived from 5 Swedish localities, were exposed for 4 months to attack by *Coniophora puteana*, *Merulius lacrymans*, *Lentinus lepideus*, *Lenzites sepiaria*, *Polyporus annosus*, *P. pinicola*, *Poria vaporaria*, *Trametes pini*, *T. serialis*, and *T. trabea*.

The sapwood was mostly destroyed by these fungi, whereas the heartwood was on the whole moderately resistant, though much variation occurred in the susceptibility of different wood samples and in the ability of different fungi to attack the wood. The outer heartwood was generally more resistant than the inner, was seriously attacked only by *L. lepideus*, and showed a high degree of resistance to *C. puteana*, *P. vaporaria* and particularly *M. lacrymans*.

No correlation could be established between density or ring breadth and resistance to attack. The content of phenolic substances, however, was correlated with resistance, analyses showing that in the majority of the specimens, the content of pinosylvin phenols was higher in the outer than in the central heartwood. The toxicity of these substances was also proved experimentally by impregnating sapwood blocks with pinosylvin and pinosylvin monomethyl ether, both of which treatments rendered the blocks more resistant, even to *L. lepideus*, than either sapwood or heartwood controls. [Cf. *For. Abstr.* 8 (No. 304).]

The legends of figures and tables are given in English as well as Swedish.

31.43. Attack by Animal Organisms

See also *For. Abstr.* 9 (Nos. 2428–32, 2534).

[2278]. 31.43 (931) : 13.2 : 33.36.1. KELSEY, J. M. **Insects attacking milled timber, poles and posts in New Zealand.** *N.Z. J. Sci. Technol.* 28B (2), 1946 (65–100). D.S.I.R.

Summarized information on insect damage to sawn timber in New Zealand. It includes a concise, illustrated description of all the most important wood-destroying termites and beetles, with aids to identification. Methods of preserving timber from attack and dealing with infestations are also described.

[2279]. 31.43 : 12.26–8 : 13.2 (669). MCKAY, J. H. **Wood borers attacking Obeche [*Triplochiton scleroxylon*].** *Fm. & For.* 8 (2), 1947 (87–89).

Cf. *For. Abstr.* 9 (No. 1623). *Apate tenebrans* is fairly common in Nigeria, but appears not to attack *Triplochiton scleroxylon*; *A. degener* and *A. monachus*, however, which are smaller, attack *T. scleroxylon* as well as other species. *Heterobostrychus brunneus* is one of the commonest and most destructive borers of this species in Nigeria. The adult beetles are not known to attack living trees. It is a pest of drying logs and sawn timber and seems never to attack starch-free wood. There appears to be ample evidence that the larvae are dependent upon starch for survival. A solution of 0·3 per cent. iodine in 0·6 per cent. potassium iodide is much more effective than iodine alone for revealing the presence of starch in wood. If the logs cannot be rendered

starch-free, the sapwood can be removed and rapidly converted to laths, weatherboarding and shingles, and given hot and cold preservative treatment. In some areas (depending on atmospheric humidity) starch depletion can be effected by barking, raising the logs on skids and brushing over with a 5-per-cent. solution of Santobrite or Dowicide to avoid stain and check pinhole borers during superficial drying. Stain and pinhole borers do not occur in the case of water storage, but starch depletion by this method is much slower and in any case Obeche logs are difficult to submerge.

[2280]. 31.43 : 13.2 : 12.26–8 (944). **Wood boring insects of New South Wales. Longicorn beetles. Part 2.** ***Phoracantha recurva*** **Newm. (The Yellow Longicorn).** ***P. semipunctata. Epithora dorsalis.*** *Tech. Notes For. Comm.* (*Div. Wood Technol.*) *N.S.W.* 2 (3), 1947 (3–5).

[2281]. 31.43 : 13.2 : 12.26–8 (410). GILMOUR, E. F. ***Trinophylum cribratum*** **Bates (Col., Cerambycidae) new to Britain.** *Ent. mon. Mag.* 84 (1004), 1948 (12–16).

An illustrated description of *Trinophylum cribratum*, previously known only from India as a pest of *Quercus dilatata* and *Q. incana*, and notes on its capture in Cowes, Isle of Wight, on *Q. robur* timber of Hertfordshire origin, and in Feltham, Middlesex, the neighbouring county to Hertfordshire. The *Q. robur* timber from which the beetles emerged was riddled with irregular meandering borings. The author suggests that the beetle may have been introduced in packing cases made of the Indian Oak timbers carrying supplies to Britain during the war.

[2282]. 31.43 : 13.2. HINTON, H. E., and MCKENNY-HUGHES, A. W. **A new pest in houses.** *Mon. Bull. Minist. Hlth.* 6, October, 1947 (175–5). P.R.

Describes 2 cases of attack by *Euophryum confine* in London houses and lists known cases of occurrence in England, both in standing trees and in structural timbers. The damage done by the beetle closely resembles that of *Lyctus* but has been found in deal. The larva appears to feed only on dead wood that is attacked by fungi. Little is known of its life history.

[2283]. 31.43 : 13.2 : 32.22 : 12.11.11 : 31.3. **Forestry pests.** *Rep. Dep. Agric. Qd. 1946–7*, 1947 (32).

Field work was nearing completion on starch resorption experiments with a number of Queensland rain-forest species such as Brown Tulip Oak [*Tarrietia argyrodendron*], Tulip Satinwood [*Rhodosphaera rhodanthema*], and Crows Ash [*Flindersia australis*], which store abundant starch in the sapwood and are subject to heavy attacks by *Lyctus brunneus*. In all these species, high ring-barking induced starch resorption to the *Lyctus*-immunity level, while in some of them the process continued until all starch had been depleted. [Cf. *For. Abstr.* 8 (No. 306).]

[2284]. 31.43 : 13.2 : 33.36.1. GAHAN, C. J. **Furniture beetles.** *Econ. Ser. Brit. Mus.* No. 11, 1946. pp. 26.

Discusses the life history, enemies, control of and damage done by *Anobium punctatum*, *Ptilinus pectinicornis*, *Xestobium rufovillosum*, and *Lyctus* species. Illustrated.

[2285]. 31.43 : 13.2 : 33.36.1. TACK, G. W. **Is this borer dangerous? Part 3—The *Lyctus* borer. Part 4—*Anobium* or the furniture borer.** *For. Prod. News Lett. C.S.I.R. Aust.* Nos. 154, 155, 1947 (3–4; 3–4).

[2286]. 31.43 : 13.2. GUNN, J. W. **Report on the semi-annual convention of Pest Control Operators of California, Inc.** *Pests* 15 (9), 1947 (8–11). D.S.I.R.

Describes successful experiments in exterminating colonies of termites by fumigating with HCN and methyl bromide the houses affected, which are wrapped and sealed to the roof in heavy kraft paper.

[2287]. 31.43 : 13.2. GULUADI, S. V. **Eradication of white ant infestations.** *Indian For.* 73 (8), 1947 (353–4).

Describes the successful eradication (1) of white ant infestations inside a building, and (2) of white ant colonies in mounds in the open, with Gammexane D 025 and Gammexane LG 140.

[2288]. 31.43 : 13.2. GAY, F. J. **A case of house infestation by a tree-dwelling colony of *Coptotermes frenchi* Hill.** *Repr.* from *J. Coun. sci. industr. Res. Aust.* 19 (4), 1946 (330–4).

Damage to a house by *Coptotermes frenchi* is described. Part of the subterranean gallery system was traced and the nest located in a

recently dead tree about 70 ft. from the house. The depth at which the galleries were found showed that the usual recommended treatment of the soil (the top 12 or 18 in.) may often be of no value. White arsenic applied to the runways within the building is thought to have caused heavy mortality in the colony. *From author's summary.*

[2289]. 31.43 : 13.2. SPOON, W., and LOOSJES, F. E. Onderzoek naar de duurzaamheid tegen paalworm van eenige tropische houtsoorten. [**The resistance of some tropical timbers to Teredo attack.**] *Ber. HandMus. ind. Inst. Amst.* No. 210, 1946. pp. 9. [Du.e.]

See *For. Abstr.* 9 (No. 1625).

[2290]. 31.43 : 12.26–8 : 31.41. EDMONDSON, C. H. **Marine borer resistance of *Syncarpia laurifolia*.** *Trop. Woods* No. 92, 1947 (44–7 + plate).

Hawaiian-grown *Syncarpia laurifolia*, unlike Australian timber from the same species, is not very resistant to attacks by marine borers. This may be connected with the absence of gum deposits in the vessels, which are present in the Australian timber.

31.8. *Quality and Defects of Timber*

See also *For. Abstr.* 9
(Nos. 2244–5, 2256, 2268, 2354, 2543).

[2291]. 31.8 : 12.25 : 64. PAUL, B. H. **Lumber grades vs. site quality of second-growth Douglas-Fir.** *W. Cst. Lumberm.* 74 (11), 1947 (73, 75, 96).

A preliminary report on a joint study undertaken by the Forest Products Laboratory, Madison and the Pacific Northwest Forest Experiment Station on the quality of second-growth Douglas Fir. The two forest areas selected for the study were respectively site quality II and site quality IV for Douglas Fir. The dominant trees of the 100-year old, site II stand averaged 170 ft. in height and 36 in. d.b.h., with stand density 200 to the acre. In the 150-year old, site IV stand the corresponding figures were 125 ft., 30 in., and 400 trees to the acre. The slow growth during the past 20 years indicated that both stands were overstocked. In both, the trees had not yet completely rid themselves of dead branches, but branches on site II trees were considerably larger. While the greater height and diameter for a given age of the trees of site II reflect the higher productivity of that area, it was found that lumber from typical logs from that site graded lower on the average than lumber from logs from site IV, the main factor involved being the condition of knots. The larger trees cut from site II contained not only larger knots, but a higher percentage of lumber with loose knots. After kiln drying, only 35 per cent. of the lumber from site II was graded No. 1 or better, compared with 69 per cent. of that from site IV. On the other hand, the total yield per acre per year of all grades on site IV would be only about half that of site II. In both stands it was clear that lumber free from knots was practically unobtainable in rotations of less than 100 years. Close stocking, pruning of side branches, and regular thinning are indicated as means of obtaining high-grade lumber; and once these conditions are fulfilled, the benefits of site quality will begin to tell.

[2292]. 31.8 : 12.26–8 : 31.27 : 32.81. PAUL, B. H. **Guides for the selection of tough hickory.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1683, 1947. pp. 5 + 1 plate. P.R.

Discusses methods of selecting Hickory in the stand, from the stand character and history, the quality of the site, and the appearance of individual trees, and of judging the quality of lumber from ring width and weight.

[2293]. 31.8 : 32.81 : 33.91 : 47. GAALAAS, H. Godt virke gir øket utbytte. [**Good quality wood increases output.**] Det Norske Skogselskap. [*n.d.*] pp. 126. [Nor.nor.] P.R.

A fairly comprehensive account of the various kinds of damage sustained by wood, from living tree to converted product. Chapters include: lack of uniformity in growth; compression wood; branchiness; damage by snow and wind, and by deer; the felling season, and damage done in felling; floating; storage; and damage done in the forest by the general public. There are 107 photographs with German and English captions.

32. HARVESTING OF WOOD. LOGGING

See also *For. Abstr.* 9 (Nos. 2324–5, 2640–42).

[2294]. 32 (759) : 12.25 : 13.15. PRESTRIDGE, J. A. **The Big Cypress Swamp—where the modern and the primitive meet.** *Sth. Lumberm.* 175 (2201), 1947 (126–30).

Logging operations in the Big Cypress Swamp in the southern peninsula of Florida are described. The present full-scale logging operation, by the Lee Tidewater Cypress Co., is based on a planned production of 1,000,000 bd. ft. of timber per week. The Cypresses [*Taxodium distichum*] of this area are more uniform in size than in most swamps and vary in the main from 16 to 30 in. in diameter, though there are larger specimens. The wood is of exceptionally fine texture and the sap ring generally very narrow, being no more than 1–2 in. wide in trees of 24–30 in. in diameter. Depth of water in the swamp averages 6–12 in. except during the dry season. The underlying stratum is a soft coral rock, usually with a top soil 2–4 ft. deep, which suffices, in most cases, for building up roads. These, once thrown up, tend to remain in good condition, but a great disadvantage in logging operations is the heavy undergrowth. Tree girdling is carried out at the same time as the preliminary road and rail construction work. Trunks are cut into 32-ft. lengths and skidded to the road, where skeleton cars haul them to the railway. The article also contains a description of some of the swamp fauna.

[2295]. 32 (941) : 82. HARTLEY, A. E. **The logging of Western Australian timbers.** *Aust. Timb. J.* 13 (8), 1947 (494, 498, 501, 535).

The size and density of Western Australian hardwoods and the relatively unbroken nature of the ground give distinctive features to operations in the Jarrah and Karri forests. The axe and crosscut saw are still almost exclusively used and loggers work on a piece-work system which eliminates the expense of supervision. Tractor haulage has now replaced more primitive methods and the logging arch used in conjunction with a tractor and winch has been introduced with success. Small logs are conveyed to the mills by motor truck. Larger logs from virgin forests are hauled by locomotive, the use of the bulldozer in constructing railways having contributed largely to their extension into hitherto unworkable areas. Cost of timber is high and haulage accounts for about 12 to 15 per cent. of it. Recovery (i.e. ratio of sawn timber to a given weight of logs) averages only between 35 and 40 per cent. Tables show the average number of employees in the Western Australian logging industry between 1911 and 1945 and the wages paid; also an analysis of the cost of sawmill operations. [Cf. *For. Abstr.* 9 (No. 2387).]

[2296]. 32 : 62 : 82 (485). FLODMAN, B. Några reflexioner rörande avverkningsarbetets organisation och tekniska utförande. [**Reflections on the organization and technical execution of logging operations.**] *Norrlands SkogsvFörb. Tidskr.* 1944 (4), (350–67). [Sw.]

A discussion in general terms of impressions gained from studies of four large logging operations in 1941–42, and especially of the need for field reconnaissance and planning. Special emphasis is laid on the conclusion that relatively high costs are justified for the planning and construction of the main extraction roads, as outlay on this item will probably reduce the more considerable maintenance costs. In the last-named respect there is room for a good deal of standardization in the width of track and runners of sledges.

[2297]. 32 : 82. ALMQUIST, G. Några synpunkter på tidsstudierna och deras användning inom skogsbruket. [**Notes on time studies and their application in forestry work.**] *Norrlands SkogsvFör. Tidskr.* 1945 (1), (23–43). [Sw.]

A discussion in general terms, with chief reference to the methods of analysing operations used by S.D.A. (The Work Studies Department of the Forest Employers' Association and the Forest Service.)

[2298]. 32 : 82 (485). MATTSON MÅRN, L. **Efficiency measures of the Job Study Department of the Forest Employers' Association and the Swedish Forest Service in forestry in Northern Sweden.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 922 (B–2), 1947. pp. 3.

[2299]. 32 : 82 (485). SUNDBERG, C. G. Bedömning av arbetsprestationen vid kastvedhuggning av rotstående skog. [**Assessment of rates of work in the felling and initial conversion of fuelwood.**] *Norrlands Skogsv-Förb. Tidskr.*.1941 (4), (355–92). [Sw.sw.]

[2300]. 32:82:76.1 (756). TROUSDELL, K. B. **Some effects of a piecework system on felling and bucking costs in Eastern North Carolina.** *Sth. Lumberm.* 175 (2201), 1947 (190–2).

32.2. *Felling and Related Operations*

[2301]. 32.25 : 07.7. HULTMARK, N. Huggarredskap: typer, vård och verkningssätt. **[Logging tools: types, maintenance and mode of action.]** *Suppl.* to *Norrlands SkogsvFörb. Tidskr.* 1946 (4). pp. 104. [Sw.] (*Meddelande från Föreningen Skogsarbetens och Kungl. Domänstyrelsens Arbetsstudieavdelning* (*S.D.A*) No. 30).

Summarizes for practical use the experience gained so far (30 references, almost all Swedish) on suitable types, proper maintenance and mode of action of manual logging tools, viz. axes (felling and cleaving), barking tools, lifting hooks and tongs, wedges and saws. The bulk of the work (81 pp.) is devoted to logging saws, with sections on the types of saw which a woodman should possess, maintenance, and the mechanics of saws in operation. There are 81 illustrations (diagrams and photographs).

[2302]. 32.25 : 07.7 : 82 (485). BLIDBERG, T., and HULTMARK, N. En verkstad för redskapsvård. **[A workshop for tool maintenance.]** *Norrlands SkogsvFörb. Tidskr.* 1945 (3), (241–71). [Sw.]

Blidberg describes the establishment and operation of a saw-filing workshop set up experimentally for one winter felling season by the Mo and Domsjö Co. at Åsele, the hub of a number of regular bus services, by which means the saws—packed in special boxes—were conveyed to and from felling areas up to 120 km. distant. The company bought new saws and hired them at cheap rates to the woodcutters, paid for transport of the saws between the workshop and the bus stop nearest to the felling site, and established and maintained the workshop and living accommodation for the filers. Saws were exchanged for maintenance every 3 days. At the height of the season the workshop employed a foreman and 3 filers, and served 110 woodcutters on 19 felling areas. The foreman was paid by the day and the filers, as soon as they were accustomed to the job, received basic wages plus piece rates. On these terms they dealt with an average of 8–9 saws per man per day, the best individual average being 11 saws per day. Two of the men, having special aptitudes for filing and setting respectively, voluntarily teamed up, and on some days reached a joint output of almost 15 saws per man per day. Wages and overheads cost the company approximately Kr. 2 per saw, of which Kr. 0·96–1·80 were covered by the hire of the saws. Woodcutters paid 0·4 öre per cu. ft. cut for the hire of two saws per week. Of cutters replying to a questionnaire, almost all thought the filing better than what they themselves could do, and all would use the service again if the opportunity recurred. The saws purchased had to be refiled before use and in future it is proposed to buy saws merely roughly filed and not sharpened. Blades and detachable handles will be bought separately, to economize in space and packing boxes for transport. The only form of mechanization at present envisaged is the use of an emery wheel for gumming.

Hultmark's contribution is concerned with a time study of saw-doctoring work at the Åsele workshop, undertaken with the object of discovering what improvements and simplifications might be possible. Timings for the various operations are tabulated. As filing the faces of saw teeth is one of the most time-consuming jobs, a new method was tried in which teeth were faced for only half of their height; these saws were used by several experienced woodcutters, who expressed approval. Setting, also a lengthy job, could be speeded up by using more easily read gauges. By these improvements, plus those mentioned by Blidberg, the output per man might possibly be increased to 15 saws per day.

[2303]. 32.25 : 07.7 (470). OSIPOV, A. I. Elektricheskie tsepnŷe pilŷ v deystvii. **[Electric chain saws in action.]** *Lesnaya Prom.* 1947 (5), (10–14). [Russ.]

An account is given of field trials of 8 types of electric saw (7 of them figured), including models designed by Konovalov, Kuosman, the Mafel company, and three VAKOPP types [cf. *For. Abstr.* Nos. 324–58; 9 (No. 952)]. None of these was completely satisfactory, and suggestions for improvement are detailed.

The trials brought out the advantage of using 1-man saws for trees of small and medium diameter, and it is recommended that

in future any mass-produced electric saws should be of two main types:—1-man saws for trees of small and medium, and 2-man saws for trees of large diameter.

[2304]. 32.25 : 12.26–8. Noyon, H. Abatage mécanique des arbres en forêt tropicale. [**Mechanical felling of tropical forest species.**] *Bois For. Trop.* No. 3, 1947 (35–8 + plates). [F.]

The use of power saws for felling trees in the tropical forests of Africa is complicated by the fact that the large-diameter species, notably *Aucoumea klaineana*, which are the only exploitable ones, often have very large buttresses up to a height of about 3 m. These are at present felled by hand, the fellers working with axes from light platforms [cf. *For. Abstr.* 9 (No. 953)] at the upper limit of the buttress. This would be impossible with a heavy power saw, and the author describes in detail a practicable method of cutting away the buttresses near the ground to a height sufficient to permit the saw to operate on the main trunk.

[2305]. 32.25.4 : 07.7 : 33.02 : 32.96. Fobes, E. W. **Improved harvesting methods. Equipment survey notes. Mobile pulpwood harvesters.** *Rep. U.S. For. Prod. Lab., Madison*, No. *R*1637–18, 1947. pp. 2. P.R.

Describes and illustrates 4 mobile harvesters used in cross-cutting and loading pulpwood. Production ranges from 35 to 60 cords daily, with 2 to 4 men, excluding loaders and skidders, on the machine.

[2306]. 32.25.4 : 07.7 : 52.2. Fobes, E. W. **Improved harvesting methods. Equipment survey notes. Log-measuring instrument.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1637–21, 1947. pp. 1. P.R.

Describes, with illustrations, a light-weight metal instrument for measuring off tree-length logs for cross-cutting, without the user having to stoop. The measuring bar is normally 4 ft. long, but can be altered for cutting odd-length products, such as ties and pulpwood.

[2307]. 32.26 : 07.7. Lyal'kin, I. A. Mekhanizatsiya nakatki i raskatki shtabeley lesa. [**Mechanization of the rolling of logs into position in stacks of timber.**] *Lesnaya Prom.* 1947 (5), (15). [Russ.]

Describes, with diagrams, a simple winch and cable lay-out for moving bundles of logs from the head of a log elevator to their appropriate place in large timber stacks, which are built up of alternate rows of logs laid crosswise and longitudinal logs acting both as stickers and as rails along which the incoming logs can be dragged.

[2308]. 32.29 : 07.7. Boyd, G. R. **Clearing land of brush and stumps.** *Fmrs'. Bull. U.S. Dep. Agric.* No. 1526, 1946. pp. 38.

Revision of a bulletin first issued in 1927. Various methods of disposal of brush (grazing, cutting and burning, ploughing), stump removal (grubbing, burning, pulling, blasting, bulldozing) and disposal are described, and the choice of method discussed.

[2309]. 32.29 : 07.7. Cox, M. B. **Brush and tree removing machinery.** *Bull. Okla. agric. Exp. Sta.* No. B–310, 1947. pp. 32.

A number of machines and chemicals for the removal of trees and shrubs and control of sprouts are being studied cooperatively by the Oklahoma Agricultural Experiment Station and the U.S. Soil Conservation Service. These include various designs of saws, beaters, shears, mowers, dozers, sweeps, shredders and crushers. Power brush mowers were the most satisfactory machines tested for cutting light brush with stem sizes ranging up to 1½ in. diameter. The brush beater consists of weighted chains fastened to a revolving shaft or drum driven by the power take-off of a tractor. This machine does excellent work in Sagebrush and can be used effectively for weed or sprout control on stumpy or stony land. A shredder type of beater appears to have great possibilities for removing heavy growth of any type of brush. Four types of circular power saw, two of them tractor-driven, have been tested. These are manoeuvreable and will do an excellent job of felling trees and brush. Large trees can be cut, but difficulty, chiefly owing to binding, increases as diameter increases. The tractor power saw can be operated on small trees and brush while the tractor is in motion. A satisfactory procedure for operating a tractor saw with the machine in motion was to cut a track round the area with sufficient room for the saw and a buck rake (a heavy mechanical rake) to operate without interference. As the saw cuts a swath, the rake

picks up the brush and pushes it out of the way, which gives the saw operator a clear view for the next swathe. The portable power saws, which are self-propelled, are more satisfactory than tractor saws for cutting trees and brush uniformly close to the ground. They are also more easily manoeuvred for thinning tree stands or working in close places. Power-lift mechanical rakes are very satisfactory for collecting and piling brush.

Tree- and bulldozers have not been tested on this project, but observations elsewhere indicate that careless or unskilled operators denude the ground of cover, thus creating serious erosion hazards. A new machine similar to a giant stalk cutter offers good possibilities for crushing or breaking the dead material of trees and bushes that have been chemically killed. All these machines are illustrated.

[2310]. 32.29.1 : 12.25. **Destroying stumps by charpitting.** *Ext. Serv. Bull. Wash. St. Coll. Agric.* No. 344, 1946. pp. 11.

'Charpitting' is a cheap method of destroying large coniferous stumps by fire, without the use of explosives or expensive equipment. The stumps are burned far below plough depth by a process similar to that used in making charcoal. From two to eight weeks are required to charpit a large stump. The requisites are a clay soil, coniferous stumps, an experienced operator, dry wood for starting fires, and systematic attention to the fires. The advantages of the method are that it is cheap and safe, that it leaves the ground in good condition for making a seedbed or planting, does little injury to the soil round the stump, allows pasturage while the charpitting is being done, and that crops grow vigorously where stumps have been burned.

32.3. *Sorting*

[2311]. 32.3 : 12.25 : 76 : 35. Bond, W. E. **More dollars from integrated utilization.** *Sth. Lumberm.* 175 (2201), 1947 (220–2).

Yields and stumpage returns of different categories of products cut at various ages from a Slash Pine plantation are given. Of the trees removed in each period and also in the final cutting, as many as are suitable should be sold for posts or poles. The rest can be marketed as sawlogs or pulpwood according to their suitability. This method of integrated utilization will bring the owner almost 5 times the income he would receive from selling pulpwood stumpage alone, and more than 1½ times that which he would receive from just sawlog and pulpwood stumpage.

32.7. *Loss in Logging. Incidental Waste*

See also *For. Abstr.* 9 (No. 2327).

[2312]. 32.7 : 12.25 : 33.32 : 22.14.2. Brender, E. V. **Pulpwood from tops.** *Sth. Lumberm.* 175 (2201), 1947 (238, 240).

Experiments were carried out in Pine stands on the Hitchiti Experimental Forest, near Macon, Georgia, to find the amount and cost of pulpwood obtainable from tops. One stand was felled selectively and in another all trees merchantable for sawlogs were felled according to the usual practice. In both cases trees were cut to a minimum top diameter of about 8 in. Pulpwood from tops averaged slightly over 1 cord per acre on the selectively felled stand and nearly 1½ cords after the usual sawlog felling. On the other hand, pulpwood from the former averaged nearly ½ cord per thousand bd. ft. of sawlogs, but from the latter only about ¼ cord per thousand. The amount of pulpwood which can be cut from tops is more closely related to the merchantable height of the saw-timber trees than to the diameter. One-log timber (16 ft. logs) yields roughly 1½ cords of stacked pulpwood per 1,000 bd. ft. of sawlogs, two-log timber nearly ½ cord, while three- and four-log timber yields a little over $\frac{1}{10}$ cord. Quality of pulpwood from tops compared favourably with that from pulpwood stands. Cost was not excessive. The two-man bow saw yields 1 to 1½ cords of pulpwood per 8–hour day. At the current wage rate of $0.60 per hour, total operating cost per cord would be $7.70 and net returns per cord $2.30.

32.8. *Grading and Storage of Wood in the Rough*

[2313]. 32.81 : 12.26–8 (76). Lockard, C. R., and Carpenter, R. D. **Interim sawlog grades for southern hardwoods, especially adapted to standing timber.** Sth. For. Exp. Sta., New Orleans. 1947. pp. 9.

32.9. *Transport*

See also *For. Abstr.* 9 (Nos. 2305, 2515).

[2314]. 32.9 (71) : 07.2 : 38.2. SILVERSIDES, C. R. **Logging research in the Institute.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 945 (B–1), 1947. pp. 2.

The Pulp and Paper Research Institute of Canada is carrying out investigations on the following problems:—(1) design of logging camps; (2) the greater use of gravity through board and metal chutes, wire skidding and cableways; (3) holding booms and holding grounds for pulpwood.

[2315]. 32.91.12 : 07.7. KOLOBOV, I. D. Trelevka malomoshchnymi elektrolebedkami v tonkomernykh nasazhdeniyakh. **[Skidding with low-power electric winches in stands of small diameter.]** *Lesnaya Prom.* 1947 (7), (7–9). [Russ.]

Describes and figures a small winch driven by a 6–7-kw. electric motor, suitable for skidding logs from stands of average diameters between 18 and 24 cm. (which account for more than half of the growing stock in the forests of the U.S.S.R.) to minor logging roads spaced 200–400 m. apart. The winch is fitted with wheels to run on a narrow-gauge railway. Its total weight is 327 kg.

The live drum develops a pull of 1,000 kg., and will haul in bundles of timber of 3 cu.m. if the latter are laid on skid-rails made of long logs. Used in conjunction with a scaffold frame carrying pulley blocks, the winch will both haul in the timber and load it on to tramway wagons.

[2316]. 32.91.22 : 07.7. JONSON, I. Isning av basvägar. **[Icing logging roads.]** *Skogen* 34 (23), 1947 (303–4). [Sw.]

Reports the successful use of a 2½-h.p. petrol-driven motor pump, weighing about 215 kg., for watering roads to be iced, and suggests that trials should be made of the much lighter pumps (3-h.p. pumps weighing less than 50 kg. are available) on the market.

[2317]. 32.91.22 : 07.7. KORUNOV, M. M. Vliyanie formy podrezov na legkost' khoda saney. **[Effect of the shape of runner shoes on the ease of running of sledges.]** *Lesnaya Prom.* 1947 (8), (8–9). [Russ.]

Experiments with sledges having runner shoes flat or curved in cross-section, under identical conditions as regards nature of ice, air temperature, track pressure, etc., showed that: (1) At temperatures of −10° C. and lower, the curved shoes had a resistance to sliding 20–35 per cent. lower than that of flat shoes. (2) Under warmer conditions the curved shoe loses its advantage: at temperatures of −2 or −3° C. the difference between the resistance of the two types did not exceed 3 per cent. and at higher temperatures the flat type was superior. (3) With curved shoes, the radius of the curve affects resistance to sliding and is of practical importance. Further work is needed on this question, to enable a proper choice of radius to be made. (4) At low track pressures (1–1·5 kg./sq. cm.) there was scarcely any difference between the resistance of the two types of shoe.

[2318]. 32.91.22 : 07.7 (470). GORBACHEVSKI, V. A. Avtomobil'nye i traktornye lesovoznye sani. **[Timber sledges drawn by lorry or tractor.]** *Lesnaya Prom.* 1947 (8), (11–17). [Russ.]

The design of timber sledges depends on the type of road used, the chief types of winter road being single-rutted or double-rutted snow/ice roads and unrutted roads of compacted snow.

The coefficients of resistance to sliding, in kg. per metric ton weight of the sledge-train, are respectively 9–17, 17–30, and 25–50 for the three types. The first-named type has also great advantages in that only one rut has to be made and iced, and that as the tracks of the sledge and those of the tractor or motor do not coincide, the requirements of minimum friction in the one case and maximum grip in the other, are reconciled. Two-rutted roads are not recommended for timber extraction. Rutless snow roads are useful for extracting small quantities of timber, as short spur roads to ordinary main roads, and in regions where frost is not sufficiently constant for iced roads.

Detailed specifications are given, with scale diagrams, of (1) the TOS–20G single-runner paired sledges, for use with a tractor; (2) the AOS–6 single-runner train, consisting of a single (semi-trailer) sledge followed by a sledge-pair, for use with a motor lorry; (3) the TSU double-runner sledge-pair for tractor haulage; and (4) the SPP–6 double-runner single (semi-trailer) sledge, for use with a lorry. (1) and (2) are intended for single-rutted iced roads, and (3) and (4) for unrutted snow roads.

Brief notes are included on the quality, species, seasoning, etc., of wood for sledges (Scots Pine is used for the larger and Birch for the smaller parts), and on their construction and upkeep.

[2319]. 32.92 (437). OČENÁŠEK, J. Vazba vorů na Vltavě a Otavě. [**The binding of timber rafts on the rivers Vltava and Otava.**] *Lesn. Práce* 26 (11), 1947 (339–47). [Cz.e.]

Discusses the types of raft and raft bindings hitherto used, with particular reference to the need for a shallow draught owing to low water in the rafting season, and possibilities of improvement. A Swedish type of raft as described by Kinnman and Löf (*Handbok i Skogsteknologi*, Stockholm 1922) is regarded as the most suitable for the purpose.

[2320]. 32.92 (470). DAROVSKIKH, I. A. Novÿ sposob formirovaniya rechnÿkh sektsionnÿkh plotov. [**New method of building sectional river rafts.**] *Lesnaya Prom.* 1947 (6), (9–10). [Russ.]

Describes (with diagrams) a method of building large timber rafts to be floated on the R. Kama, and the lay-out of the booms forming the bays in which the work is done. The method was devised by the Central Timber-floating Research Institute of the U.S.S.R.

[2321]. 32.92–4 : 07.7. ***Karen* challenges the pike pole.** *Timberman* 49 (2), 1947 (40–44, 84–85).

Description of a crash boom boat designed for the Comox Co. of Vancouver Island for use in its booming grounds. This stoutly built 16-ft. craft has an 8-ft. beam and a 100-h.p. marine engine, and costs $10,000. Stern and bow are heavily reinforced and there is a special spiked bumper on the nose. She is extremely easy to manoeuvre and sorts and rafts logs with great ease and speed, making pike-pole work largely unnecessary.

[2322]. 32.94 (66 : 67 : 44). CERMAK, F. L'amenée en France des bois africains flottants par radeaux de haute mer. [**Floating African timbers to France by ocean-going rafts.**] *Bois For. Trop.* No. 3, 1947 (66–74). [F.]

Examines the possibility of towing West African timber to the French Channel ports in the form of Davies rafts. The climatic, seasonal, and meteorological factors are reviewed. Okoumé [*Aucoumea klaineana*] is the only important species which will float, but a percentage of non-floating species could be made up in Okoumé rafts. The methods of constructing and breaking up the rafts are described. As far as the Cape Verde Islands, rafting would be favoured by the ocean currents and the S.E. trades, but would thereafter face contrary currents and prevailing winds. Probable costs are analysed. The possibility that such rafts could not stand up to the force of the ocean swell is admitted, but a trial is strongly urged.

[2323]. 32.96 : 07.7 : 32.91.4. NIKOL'SKI, B. Elevator-brevnogruzhatel' EZhD-2. [**The EZhD-2 log loader.**] *Lesnaya Prom.* 1947 (5), (16–17). [Russ.]

Describes and figures a self-propelled elevator, designed to work on railway sidings, for transferring logs from railside stacks on to wagons. It has a capacity of 5·7 logs/minute, taking logs up to a top diameter of 50 cm. and 4·8 m. in length. A winch is fitted, with which bundles of logs totalling 3 cu.m. can be dragged from a radius of 100 m. The apparatus propels itself at 2·5 km./hour and is driven by a 40-h.p. petrol motor.

33. CONVERSION AND PRESERVATION OF WOOD

[2324]. 33 (596–9) : 32.91. ALLOUARD, P. Les industries du bois de l'Indochine vous demandent conseil. [**The wood industries of Indo-China ask your advice.**] *Rev. Bois Appl.* 2 (1), 1947 (11–16). [F.]

Discusses problems arising in the savanna and virgin forest areas of French Indo-China in regard to exploitation and transport, firewood and charcoal and the use of small dimension stock. [Cf. *For. Abstr.* 9 (No. 2033).]

[2325]. 33 : 32 : 35 : 98.3. SOUZA, P. F. DE. Indústria madeireira. [**The timber industry.**] Imprensa Nacional, Rio de Janeiro. 1947. pp. 344. [Port.] P.R.

A comprehensive work summarizing, to date, the most important aspects of the Brazilian timber industry. Theory, methods, and machinery are dealt with under the following heads:—sawmilling, logging, seasoning, wood preservation, classification of timbers, timber markets (with some details and figures for exports from 1939 and 1945), constructional

materials (listing vernacular and scientific names), plywood, fibreboards, sawdust briquettes, wood waste, rayon and plastics.

33.1. *Mechanical Conversion excluding the Manufacture of Mechanical Pulp*

[2326]. 33.1 (73) : 33.36.3 : 33.91 : 35 : 98 : 06.2. BROWN, N. C. **Lumber—manufacture, conditioning, grading, distribution and use.** John Wiley & Sons, Inc., New York. 1947. pp. 340. Price $4.25 (25*s.* 6*d.*).

A general survey (with particular reference to conditions in the United States) with chapters on: history, economics, and general considerations; the manufacture of lumber; conditioning by air seasoning and kiln drying; re-manufacture (planing and moulding); grades and inspection; the small sawmill; sizes and price relationships; marketing, distribution and use; shipping and other transport; export, and lumber trade associations. There are 119 photographs and diagrams.

Use of Wastes

See also *For. Abstr.* 9 (Nos. 2351–2, 2449–50.)

[2327]. 33.1 : 34.6 (73) : 32.7 : 33.3 : 34.24 : 09.4. **Wood waste in the United States.** *Reappraisal Rep. U.S. For. Serv.* No. 4, 1947. pp. ii + 45.

An appraisal of the wood-waste situation in the U.S.A. At present only 43 per cent. by weight of wood cut in logging is marketed in products other than fuel; 35 per cent. is not used at all; the remaining 22 per cent. is used for fuel—much of it inefficiently. The report describes and assesses by regions the nature and quantity of waste in logging, milling, pulping and other forest-products industries, makes suggestions for more economical procedure, and describes methods of using waste wood in the pulping, distillation, hydrolysis and tanning industries. Greater integration of the forest-products industries, the extension of sustained-yield forest management, increased technical research, technical assistance to owners and processors, and public aid in financing pioneer operations in the utilization of wood waste are recommended.

[2328]. 33.1 : 34.6 : 07.7 : 33.7. **Converting waste wood into steam power.** *Wood Prod.* 52 (9), 1947 (16, 18).

A steam-power plant burning wood waste has been installed in the Algoma, Wisconsin, mill of the United States Plywood Corporation. Each boiler has a dutch-oven type of furnace, which effectively burns the hogged waste wood. Planer shavings and sawdust are picked up from the production machines by suction pipes and blowers, and pass through cyclone-type separators (which also serve as ventilators) before being conveyed to the furnace. Dust is stored in suspension in a separate cyclone-type separator where an automatic device discharges the material to the furnace when the mixture reaches the right density for safe and efficient combustion, a device which considerably reduces explosion hazards.

[2329]. 33.1 : 34.6 : 07.7. BALTZER, C. E., and PRINCE, J. B. **The use of sawdust as fuel at portable and small stationary-type sawmills.** *Mimeo. For. Prod. Lab., Can.* No. 127, 1947. pp. 7 + 4 plates. See also *Timber of Canada* 8 (4), 1947 (36–7, 76–83).

Describes with illustrations the design and construction of the dutch-oven furnace extension as applied to the fire-box of boilers used by small sawmills, in order to make possible the efficient burning of sawdust.

[2330]. 33.1 : 34.6 : 33.7 : 07.7. **Wood waste as a fuel.** *Leafl. For. Prod. Res., Lond.* No. 41, 1947. pp. 10.

Gives illustrated descriptions of wood-waste furnaces designed for industry and the home, and describes generally 4 main methods of manufacturing sawdust and pulverized wood waste into briquettes. [Cf. *For. Abstr.* 4 (52) 5 (272).]

[2331]. 33.1 : 34.6. MESANGUY, M., KRAFFE DE LAUBARÈDE, L., and BRICK, M. **Composition for the preparation of combustible sawdust agglomerates.** *Belg. Patent* No. 449,452, April, 1943. *Chem. Abstr.* 41 (20), 1947 (6694). P.R.

The briquettes are obtained from sawdust agglomerated with a mixture of vegetable gums, Na_2CO_3, colloidal clay and trioxymethylene or *o*- or *p*-hydrobenzoic acid.

[2332]. 33.1 : 34.6. REINEKE, L. H. **Briquets from wood waste.** *Sth. Lumberm.* 175 (2199), 1947 (54, 56).

A review of current methods of making briquettes from sawdust, shavings, bark, chips, etc. including the Pres-to-log and Glomera machines, and the Seaman method.

[2333]. 33.1 : 34.6 : 33.32. BYRTE, H. C. **Manufacture of fire-lighters.** *Brit. Patent* No. 584,200, Dec. 13, 1944. *Brit. Abstr.* BI, April, 1947 (123). P.R.

Wood, bark, or similar material in the form of chips, lumps, or shavings, is added to coarse cellulosic pulp from which the combustible sheets are to be formed. This makes the sheets rougher in surface and more accessible to air during combustion.

[2334]. 33.1 : 34.6 : 33.32.3. COLLIE, G. A., ELLISON, J. G., and WILSON, R. F. **The German manufacture of wood-waste board.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 1526, Item No. 22, 1947. pp. 28 + 8 + 14 plates. P.R.

Reports on visits to 7 firms using wood waste as fuel or for board manufacture, and to 3 manufacturers of hogging machines. Only one of several processes for the production of board-like materials from wood waste had reached production on a commercial scale. This is for a medium-density wood-board substitute, 'Bresco', made from plywood-factory waste wood and consisting of veneer and wood chips bound together with synthetic-resin adhesive. Other products—'Lignova', 'Tronora' and 'Tronal'—had been held up by the war-time shortage of glues. The hogging machines were very efficient. Appendixes describe bowls and plates made of wood chips and shavings and a resin binder, with illustrations of the plants and products, and photostats of pamphlets on the hogging machinery.

[2335]. 33.1 : 38.1 (431–5). THOROGOOD, A. L. **Supplementary report on the German wood wool building slab industry.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 1489, Item No. 22 [1947]. pp. 45 + 6 dgms. + plates. [Ministry of Works.] P.R.

Five factories were revisited [cf. *For. Abstr.* 9 (No. 1108)] and 12 others, using cement, gypsum or magnesite as binders, visited. A new process, not yet in production, which would use considerably less timber, was investigated. Two factories were producing short-fibred wood-wool slabs and claimed that these are stronger in compression than the normal long-fibred slabs.

[2336]. 33.1 : 34.6 : 38.1. PARKER, T. W. **Sawdust cement and other sawdust building products.** *Chem. & Ind.* 1947 (39), (593–6). P.R.

Discusses the properties of 'sawdust-cement', a product formed from a mixture of Portland cement and sawdust in varying proportions, and the pre-treatments designed to obtain uniformity between different batches of the mix. Results of laboratory tests of strength and durability are tabulated. Describes more briefly the use of other organic and inorganic binders (synthetic resin and glues, plaster, and magnesium-oxychloride cement) and the properties of the resulting products.

[2337]. 33.1 : 34.6 : 38.1. DAVIES, I. R. B. **Improvements in building materials.** *Brit. Patent* No. 589,372, Feb. 27, 1945. *Brit. Abstr.* B1, 1947 (283). P.R.

Sawdust or other fibrous material is impregnated with an aqueous solution of caustic alkali or alkali silicate, set aside for some hours, then mixed with Portland cement and a relatively small proportion of ground gypsum gauged with aqueous $CaCl_2$, and the resultant mixture moulded.

33.12. Joinery, Turnery

See also *For. Abstr.* 9 (Nos. 2236, 2350).

[2338]. 33.12 (410) : 07.1 : 07.2 : 35 : 82 : 98 : 33.36.1 : 33.36.3. **Board of trade working party reports. Furniture.** H.M. Stationery Office, London. 1946. pp. 209. Price 3*s.* 6*d.* P.R.

Report of the Working Party set up in 1945 to study methods of improving the British furniture industry. A general survey of the industry is followed by detailed studies of problems connected with raw materials, the structure and growth of the industry, technical developments and research, labour questions, standards, design, education, utility furniture, retail, distribution and export. Recommendations are made under each head. They include the establishment of a committee to investigate timber, plywood and veneer supplies and the setting up of a National Furniture Council to ensure that the recommendations of the report are carried out, to act in an advisory capacity

to the industry and to initiate the establishment of a National Furniture College, a Technical Research Association, a Design Centre and an Economic Intelligence Service. Appendixes include a report on the American furniture industry, notes on wood-destroying beetles and the kiln-drying of timber, recommendations on design submitted by the Council of Industrial Design and a summary of developments in the inter-war years in the principal foreign markets for furniture.

[2339]. 33.12 : 31.22.1. **Method for controlling the moisture content of wood going into furniture production.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1685, 1947. pp. 10 + 3 tbls + 3 gphs. P.R.

Describes the control-chart method of checking moisture content of wood, after drying and before assembly. Gives specimen charts, and formulae for obtaining the central lines and control limits for average moisture content and standard deviation, using inspection data gathered over a period of time. Experiments at a co-operating furniture plant indicate that the method is practical and that a small number of samples per day checked for moisture content will provide sufficient information for control purposes. [Cf. *For. Abstr.* 9 (No. 2378).]

[2340]. 33.12. HYLER, J. E. **A brief analysis of modern practice in wood coping.** *Wood Prod.* 52 (9), 1947 (18, 20, 22).

[2341]. 33.12 : 07.7 (431–5). MORRISON, W., JEWITT, J., SMITH, W. C., WAXMAN, S., MARVIN, A., and STEVENSON, B. **German hand tools industry. Light edge tools.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 1628 (Section 4), Item No. 31 [*n.d.*], pp. 29. P.R.

Describes visits to 53 firms making woodboring tools, planes, tool handles and miscellaneous products including carpenters' wooden benches, tennis racquets and bentwood furniture.

[2342]. 33.12 : 07.7. HAYWARD, C. H. **Tools for woodwork. The sharpening, care, and use of hand tools.** Evans Brothers Ltd., Montague House, Russell Square, London, W.C.1. 1946. pp. 102. Price 7*s.* 6*d.* P.R.

[2343]. 33.12 : 07.7. KÖBERLE, J. **Ein** Bilderbuch für Holzbearbeitungsmaschinisten. **[An illustrated handbook for machine-woodworkers.]** Verlag VSSM, Bahnhofplatz 9, Zürich. 1946. pp. 53. [G.] P.R.

[2344]. 33.12 : 07.7. LISTER, S. **Sanders and sanding.** Lomax, Erskine & Co., Ltd., 154 Fleet Street, London. 1948. pp. 76. P.R. Price 5*s.*

33.13. Cooperage. Shingles

[2345]. 33.13 : 02.1 : 33.6. HANKERSON, F. P. **The cooperage handbook.** Chemical Publishing Co., Inc., Brooklyn, N.Y. 1947. pp. vi + 182. L.S.

The books opens with a historical survey of the cooperage industry. Methods of manufacturing various types of tight, slack and beer barrel are described with information on handling, loading, storage, use of linings, opening and closing, etc. Federal specifications and those of the U.S. Interstate Commerce Commission, the Associated Cooperage Industries of America Inc., the Navy Department and the U.S. Department of Agriculture are also included.

[2346]. 33.13 : 33.15.2. STERN, E. G. **Tight plywood cooperage.** *Repr.* from *Nat. Hardwood Mag.* Dec., 1947. P.R.

Describes, with illustrations, the methods of manufacturing moulded plywood barrels for beer and whisky.

[2347]. 33.13 : 33.15.2. **Barrel head and staves are bonded with phenolic resin.** *Mod. Plastics* 24 (7), 1947 (98–9). P.R.

The staves and heads consist of nine $\frac{5}{32}$-in. plies of well seasoned Oak and Maple, bonded with phenolic resin, some of the plies being cross-grained to give extra strength. Nine staves are used for each barrel, which with the addition of the 2 heads makes 11 parts as against 22 to 29 in the conventional barrel; leakage danger is thus reduced. A coat of pitch applied to the inside of the barrel prevents moisture from penetrating.

[2348]. 33.13 : 12.25 : 33.91 : 38.2. GRONDAL, B. L., and WOODBRIDGE, W. W. **Certigrade handbook of Red Cedar shingles.** Red Cedar Shingle Bureau, Seattle, Washington. 1942. pp. 100. P.R.

Details the quality of timber and workmanship required by the Red Cedar Shingle Bureau for different grades of 'Certigrade' shingles; and gives recommendations, fully illustrated, for applying shingles, with sections on roof pitch, spacing, nails, applying a new roof (or wall) over an old one, ventilating enclosed areas, the use of stains and paints, and the durability, wind and hail resistance, and insulating qualities of shingles. A chart of covering capacity and nail requirements of different shingle sizes is also given.

33.15. Manufacture and Use of Veneers and Laminated Wood. Improved Woods. Laminated Materials other than Wood. Glues and Gluing

[2349]. 33.15 : 02.1. MEYER, L. H. **Plywood—What it is—What it does.** McGraw-Hill Book Co., Inc., New York and London. 1947. pp. v + 250. $3.50. I.F.B.

A comprehensive manual dealing with all aspects of plywood manufacture and utilization. Methods of veneer cutting, assembling and gluing and the properties—mechanical strength, stability, insulation, etc.—of the products are expounded. A chapter deals with the many uses of plywood, among which are building construction, boat- and aircraft-building, cabinet- and furniture-making. Under the heading 'plywood marketing' some important U.S. Commercial Standards covering Douglas Fir and hardwood plywoods are summarized. Engineering data on plywood of different species are tabulated, and the manufacture and properties of specialized products including papreg, metal-faced plywood, types of curved panels, mouldings, laminated beams and ship's timber and sandwich constructions are also dealt with. Tables give strength values for 3-ply panels of various species, strength comparisons of 3-, 5-, 7- and 9-ply Yellow Birch, specifications for aircraft plywood, comparative strengths of 17 plywood timbers and basic stresses for clear timber. The book is abundantly illustrated and contains a glossary and an appendix on glues.

[2350]. 33.15 (431–5) : 07.7 : 33.12 : 33.4 : 33.8. LACEY, P. M. C., RUTHERFORD, H. C., POLLARD, G. J. T., and AUSTIN, J. B. **Investigation of targets connected with the German plywood, improved wood, shuttle block and joinery industries.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 348, Items 22 and 31, 1945. pp. 75 + 9 + plates. P.R.

Describes methods, machinery, and lay-out of 25 plants manufacturing plywood and blockboard machinery, plywood, blockboard, doors, windows, and door and window fittings, furniture, woodworking machinery, metal-faced plywood and textile shuttles. There are few significant improvements but machinery with new features, and plans for pre-fabricated houses using improved wood for floors, walls, ceilings and roofs, are described in detail.

[2351]. 33.15 (431–5) : 07.7 : 34.6. CHOWN, W. R., and FALK, E. **Investigation of targets connected with the German plywood industry.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 529, Item No. 22, 1946. pp. 19. P.R.

There are no outstanding developments in the manufacture and use of plywood by the firms visited. An efficient boiler-plant using sawmill waste is described.

[2352]. 33.15 (431–5) : 34.6. BENÉ, J. **Yield and wood waste utilization in German hardwood plywood plants.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 1586, Item No. 22, 1947. pp. 14. P.R.

Describes the equipment and methods used in 5 plywood plants. Methods are conventional and few phases of the work mechanized. There is much pessimism over future supplies of home-grown Beech to the plants.

[2353]. 33.15 (79). **Seventeenth annual plywood review.** *Timberman* 49 (3), 1948 (39–184).

Reviews the Pacific Coast plywood industry, including production statistics, new manufacturing techniques, and many new uses and applications of plywood.

[2354]. 33.15 : 12.26–8 (548.7) : 31.0 : 31.8. **Ceylon plywood—timbers used in its manufacture.** *Timb. Tr. J.* 183 (3717), 1947 (998).

Timber for plywood manufacture in Ceylon comes from the various wet-zone forests of the Southern Province. The soft timbers are used by the Government Plywood Factory at the estuary of the Gin Ganga River. Kirihembiliya (*Palaquium petiolare*), Arrida (*Campnosperma* sp.), Uruhonda (*Lasianthera apicalis*), Bomi

[*Litsaea glutinosa*], Keena (*Calophyllum tomentosum*), Hora (*Dipterocarpus zeylanicus*), Del (*Artocarpus nobilis*), Tiniya (*Doona congestiflora*), Diyataliya [*Mastixia tetrandra*], Kekuna (*Canarium zeylanicum*), Kokun (*Kokoona zeylanica*) and Wal-Jul (*Limonia acidissima*) are some of the species that are felled by primitive methods and floated or transported by lorry to the factory, whose minimum daily requirements are between 1,000 and 1,200 cu. ft. Yield of timber per acre is very small. A fairly modern sawmill is run close to the main plywood factory, and supplies timber for local building purposes. Unpeelable logs are frequent and usually have the appearance of tension wood, only the characteristics are more pronounced.

[2355]. 33.15 : 12.25 : 12.26–8. **Possibilities of the substitution of western softwoods for Basswood as a cross-banding and core material.** *Rep. Nth. Rocky Mt. For. Range Exp. Sta.* 1946 (17).

Selected veneer logs of Ponderosa Pine, Western Larch, Western White Pine, and Engelmann Spruce were used for the production of a variety of veneers and plywoods. Results indicate that these woods are not a satisfactory substitute for Basswood [*Tilia* sp.] core stock and cross-banding where plywood is used for curved or moulded products; but flat plywood of excellent quality was produced.

[2356]. 33.15 : 12.26–8 : 31.0 (77). TOOLE, A. W. **Aspen for core stock.** *Lake St. Aspen Rep.* No. 11, 1947. pp. 9.

Aspen has many of the characteristics necessary for making good core stock. It produces a strong glue line with any of the standard glues and has low shrinkage and swelling properties Its machining qualities resemble those of other soft-wooded hardwoods. Aspen has a fine, uniform texture, is moderately light but tough and, except for an appreciable amount of collapse in boards cut from the inner portions of some trees, it seasons quickly and easily. It is readily available at reasonable cost in the Lake States of the U.S.A. and can be produced by standard methods and with standard equipment. A summary of manufacturing methods is given.

[2357]. 33.15 : 12.26–8 : 12.25 : 33.36.3. **Veneer production.** *Rep. For. Prod. Aust. 1946–47*, 1947 (39–40).

Drying of veneers of *Eucalyptus gigantea*, *E. obliqua*, *E. regnans* and *E. sieberiana* was achieved satisfactorily at the Division of Forest Products when veneers were cut at a large angle to the growth rings. *Araucaria klinkii* proved to have very satisfactory peeling and drying properties. *Pinus caribaea* and *P. taeda* from Queensland are now being investigated for plywood manufacture.

33.15.1. *Manufacture of Veneers and Laminated Wood*

See also *For. Abstr.* 9 (No. 2225).

[2358]. 33.15.1 : 07.7 (431–5). KNIGHT, R. A. G., and DUFF, G. B. **W. Ritter Maschinenfabrik, Hamburg. Machines for plywood manufacture.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 1424, Items 22 and 31, 1947. pp. 7. P.R.

[2359]. 33.15.1 : 07.7. FLEISCHER, H. O. **Reeling veneer to increase efficiency and reduce waste.** *Sth. Lumberm.* 175 (2201), 1947 (301–2, 304).

Describes various methods of rolling veneers on to spools as they come off the rotary lathe. In a simple, hand-operated reeling system devised by the Forest Products Laboratory, Madison, the reel is built about a 1-in. steel centre shaft, is supported on a light steel A-frame, and is set immediately ahead of the lathe. A reel approximately 5 ft. long serves a lathe having a 52-in. knife; the veneer is wound under very slight tension and in the reverse direction to the way in which it comes off the bolt.

[2360]. 33.15.1 : 07.7. [**A new veneer press.**] *Timber News* 56 (2103), 1948 (39).

The press, which is steam-heated, has a working pressure of 200 lb./sq. in. of platen area and a maximum temperature of 300° F. It is fitted with a rotary mono-radial pump of the automatic 2-stage type. This has an initial low-pressure output, followed by a high-pressure output giving a final increased pressure on completion of the closure of the press. By this means, a quick closing and opening time of the platens is achieved.

[2361]. 33.15.1 : 07.7. PERRY, T. D. **Curved plywood—flexible pressure for**

compound curves. *Wood Prod.* 52 (11), 1947 (39–40, 44, 47–8, 50).

An illustrated account of bag-moulding processes.

[2362]. 33.15.1 : 07.7. STEWART, J. S. (to Curved Plywood Products Co.). **Plywood.** *U.S. Patent* No. 2,418,100, Mar. 25, 1947. *Mod. Plastics* 25 (1), 1947 (138). P.R.

A machine for making plywood in curved shapes, comprising: a die shaped to conform to the desired shape; a flexible belt adjacent to the die, on which layers of veneer and bonding material may be placed; means for holding the belt taut; means for forcing the die towards the belt, thereby pressing the veneer against the die; and means for pressing the rolls towards each other, whereby, when the die is forced against the veneer, the veneer and belt will be carried between the rolls.

[2363]. 33.15.1 : 11.11 : 31.27 : 12.25. HIGGINS, H. G. **A critical temperature range in the plastic deformation of plywood.** *Repr.* from *J. Coun. sci. industr. Res. Aust.* 19 (4), 1946 (455–62). *Repr. For. Prod. Aust.* No. 93.

An experiment is described which was designed to investigate the effect of temperature on the residual deformation of plywood panels pressed for a fixed time under varying loads. It was found that, for oven-dry material, the load at which appreciable residual deformation took place declined rapidly with rising temperature from 120° to 160° C., and was very small above 160° C. The virtual disappearance of a yield value at or near this temperature represents a fundamental change in plastic behaviour, which, it is surmised, may be related to the physical properties of the lignin in the wood. *From author's summary.*

[2364]. 33.15.1 : 33.12 : 12.26–8 (768). BATSON, B. A., and LAMBERT, R. D. **Laminated [flooring] lumber from low grade hardwoods. Production data from pilot plant and production cost estimates.** Regional Products Research Division, Commerce Department, Tennessee Valley Authority. Revised, 1946. pp. vi + 76 + 7 + 6 + 1 + plates + dgms. P.R.

Cf. *For. Abstr.* 8 (No. 364); 9 (No. 1686).

33.15.2. *Use, Strength and Durability of Plywood and other Laminated Wood*

See also *For. Abstr.* 9 (Nos. 2260, 2262, 2346–7, 2454, 2458–64, 2466–9).

[2365]. 33.15.2 : 31.27 : 33.8. FREIBERGER, W., SHAW, F. S., SILBERSTEIN, J. P. O., and SMITH, R. C. T. **Plywood panels in end compression. Flat panels with grain at various angles to direction of loading.** *Rep. Aust. Coun. Aeronaut.* No. 30, 1947. pp. 35. P.R.

[2366]. 33.15.2 : 31.27 : 33.8. SILBERSTEIN, J. P. O. **Plywood panels in end compression. Curved panels with grain at various angles to the generators.** *Rep. Aust. Coun. Aeronaut.* No. 31, 1947. pp. 25. P.R.

[2367]. 33.15.2 : 31.46 : 33.15.5. STERN, E. G. **Limitations in cross-laminating of Oak under extreme service conditions.** *Bull. Va. polyt. Inst.* 40 (6), 1947. pp. 48 + 3 gphs. P.R.

Three-ply cross-laminated Oak panels 7 × 7 or 12 × 12 in. in size and of $\frac{25}{32}$ or $1\frac{1}{4}$ in. total thickness, with an Oak or Yellow Poplar core, were subjected to exposure tests consisting of drying cycles at slightly below 100° C. or soaking cycles or alternations of these in order to determine the influence of internal stresses due to exposure on the dimensional stability and durability of the panels.

The results indicate that these panels can be cross-laminated satisfactorily and withstand extreme exposure conditions, such as may occur in service, if their cross-section is properly balanced and their plies properly assembled. Phenol - resorcinol - resin glue proved better than urea-formaldehyde resin glue for panels subjected to extreme exposure conditions. *From author's summary.*

33.15.3. *Improved Woods*

See also *For. Abstr.* 9 (No. 2274).

[2368]. 33.15.3. MILLETT, M. A., and STAMM, A. J. **Wood treatment with resin-forming systems. A study of size and species limitations.** *Mod. Plastics* 25 (1), 1947 (125–7). [Forest Products Laboratory, Madison, Wis.] P.R.

Solid wood specimens, 2 × 2 in. × 4 ft. and 2 × 2 in. × 6 ft., taken from the sapwood of 9 species of commercial timbers, were pressure-treated with solutions of dimethylol and urea-formalin resins and of a water-soluble phenolic resin. After 2 weeks of kiln drying the treated specimens were cured under contact pressure in a hot-plate press at 310° F. for 7 hours. Data of anti-shrink efficiency and increases in specific gravity and hardness were then obtained. In all cases specimens showed appreciably less improvement in hardness and moisture resistance than has been obtained from panels made from individually treated plies of veneer. Moreover the treating, drying and curing of solid wood takes considerably more time than would be needed for making similar-sized specimens from glued and treated veneer. The treatment of larger solid wood specimens would not be practical commercially, even for the treatment of sapwood. *From authors' summary.*

[2369]. 33.15.3 : 31.27. ERICKSON, E. C. O. **Mechanical properties of laminated modified wood.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1639, 1947. pp. 16 + 9 tbls. + 1 dgm. + 5 gphs. + 3 plates. P.R.

Presents graphically the results of tests on modified Yellow Birch, Sweetgum and Sitka Spruce laminates made at the Forest Products Laboratories from 17-ply panels of $\frac{1}{16}$-in. veneer. Testing procedures are described.

Resin impregnation was shown to increase moisture resistance and strength in compression, and, to some extent, the shear in the plane of the plies, but to reduce tensile and impact strength and toughness.

Resin impregnation plus compression increased all properties except toughness and impact strength.

Compression without impregnation increased most properties in proportion to the increase in density. Wood so treated had much the same toughness and impact strength as ordinary wood; it was less moisture-resistant than resin-impregnated wood.

[2370]. 33.15.3 : 31.22.2. STAMM, A. J., and TARKOW, H. **Dimensional stabilization of wood.** *J. phys. colloid Chem.* 51 (2), 1947 (493–505). D.S.I.R.

Reviews briefly the existing processes for stabilizing wood and describes in detail the acetylation of wood by a vapour treatment using acetic anhydride and pyridine. The rate of acetylation is determined by the rate of diffusion of the vapours, which varies with the thickness of the wood; to maintain practical treating times, the process should be confined to veneers of $\frac{1}{8}$-in. thickness or less, or to solid wood only a few inches long in the fibre direction. The time required to obtain a degree of acetylation that gives 70 per cent. reduction in swelling and shrinkage under equilibrium conditions decreases with increased temperature. Strength tests so far made indicate that dry acetylated wood has practically the same strength properties as untreated controls; toughness is either unaffected or increased by as much as 20 per cent. Laboratory and service tests proved the treated wood to be resistant to decay, termites and marine borers. The dimensional stabilization is due primarily to a bulking effect by the acetyl groups, which causes an increase in the dry dimensions without increasing the wet dimensions.

33.15.4. *Laminated Materials other than Wood*

[2371]. 33.15.4. SEIDL, R. J. **Paper and plastic overlays for veneers and plywoods.** *B.C. Lumberm.* 31 (11), 1947 (94–6, 100, 102).

[2372]. 33.15.4 : 33.15.5. EICKNER, H. W. **Durability of glued joints between aluminum and end-grain Balsa.** *Rep. U.S. For. Prod. Lab., Madison* No. 1566, 1947. pp. 8 + 2 tbls. + 2 plates. P.R.

[2373]. 33.15.4 : 33.15.5. TIGELAAR, J. H. **Metal to wood bonding.** *B.C. Lumberm.* 32 (1), 1948 (57–8, 97–8, 100–1).

A general account is given of the properties and uses of metal-faced plywood, and a table sets out the comparative strength properties of plywood, sheet aluminium, sheet steel, and plywood faced on one and on both sides with aluminium and with steel, in a number of thicknesses. The same stiffness factor obtains for a 6-gauge steel sheet, a $\frac{5}{16}$-in. aluminium sheet, $\frac{3}{4}$-in. plywood panel, a $\frac{5}{16}$-in. steel-faced panel and a $\frac{1}{2}$-in. aluminium-faced panel, weighing 8·1, 4·4, 2·1, 2·4, and 1·65 lb./sq. ft. respectively. The necessary qualities in an adhesive for bonding wood to metal are discussed, and some of the more commonly used glues (both cold- and hot-setting) are described.

[2374]. 33.15.4 : 33.15.5. BERBÜSSE, H. **Steel-wood bonding cements. Focke-Wulf test report Vers. 3618, 28th October, 1944. First interim report.** Translated by L. B. Russell. *Transl. Minist. Supply* No. G.D.C. 16/427 T [*n.d.*] pp. 2 + 3 tbls. + 1 gph. P.R.

Tests were made on units formed by hot gluing of a thin veneer or plywood bonded to steel by Tegofilm. Two sets of specimens, each dry, wet, and re-dried, were tested for shear strength, resistance of the veneer to lifting or tearing off, and the tensile load. In the first set, in which, apparently, the necessary moisture content had not been present during pressing, the specimens came apart in re-drying although the dry shear strength was satisfactory. The second set showed satisfactory values for all tests. The results are given in tables and graphs.

[2375]. 33.15.4 : 31.27 : 33.15.2. BÜRNHEIM. **The fatigue endurance of steel/plywood bondings. F.W. experimental report.** *Transl. Minist. Supply* No. G.D.C. 16/428 T [*n.d.*], pp. 2 + 2 gphs. [E.] P.R.

35.15.5. *Glues and Gluing*

[2376]. 33.15.5 : 07.7. YAVORSKY, J. M. **A comparison of hot platen and radio frequency heating.** *Abstr.* of thesis in *J. For.* 46 (2), 1948 (118). [N.Y. State Coll. of For.]

Report on a study of rates of heating in plywood panels produced by thermal diffusion from heated platens and dielectric heating, respectively. In general, dielectric heating was found to be the more efficient.

[2377]. 33.15.5 : 07.7. CUNNINGHAM, J. B. **High-frequency gluing.** *Sth. Lumberm.* 175 (2201), 1947 (116).

Two new 'Woodwelding' developments have now been perfected. (1) An automatic remote-control tuning unit, used with the portable type of 'Woodwelder' in order to speed up and keep accurate control over high-frequency gluing in mass-produced assemblies. (2) An automatic plywood patcher, consisting of a 5-ft.-high pedestal with a revolving 6-ft. arm, holding patching electrodes, which can press down on the patch with a maximum force of 300 lb./sq. in.

[2378]. 33.15.5 : 31.22.1 : 33.12. WANGAARD, F. F. **The control of moisture content in gluing for furniture manufacture.** *Sth. Lumberm.* 175 (2201), 1947 (223–6).

The moisture content of wood when glued should approximate to that encountered in service. The moisture added in the gluing process should be taken into account and further conditioning applied when necessary. This additional moisture content varies with species, thickness of plies and type of glue. Some data are given. Problems connected with uniformity of moisture content in the glued product and the effect of moisture content on glue joint quality are also considered. [Cf. *For. Abstr.* 9 (No. 2339).]

[2379]. 33.15.5. SELBO, M. L. **Effect of clamp spacing on the quality of glue bond in laminated White Oak timbers glued with an intermediate-temperature-setting phenol-resin glue.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1670, 1947. pp. 5 + 2 tbls. + 8 figs. P.R.

Describes tests on White Oak laminated timbers glued for 18 hours at 210° F. with different clamp spacings and caul thicknesses. The results are tabulated. The conclusions drawn are that in laminating straight members an average gluing pressure of 150 lb./sq. in. gives uniformly good glue bonds provided the clamp spacings are not greater than the following:—

Thickness of caul	clamp spacing
2 in.	18 in.
¾ in.	9 in.
⅜ in.	6 in.

These conclusions are based on the single phenol resin glue used; modifications may be necessary for other glues.

[2380]. 33.15.5 : 31.27 : 33.15.2. KLINE, G. M., REINHART, F. W., RINKER, R. C., and LOLLIS, N. J. DE. **Effect of catalysts and pH on strength of resin-bonded plywood.** *Mod. Plastics* 24 (11), 1947 (123–8, 196–202). P.R.

The effects of various catalysts, used to cure resinous adhesives, on the strength properties of plywood were investigated, particularly with regard to the degree of acidity developed by the catalysts in the resin film and in the plywood. The flexural, impact and shear strengths, both initially and after ageing, of Birch plywoods bonded with urea-formaldehyde and phenol-formaldehyde resins, definitely decrease as the

acidity of the plywood increases, as evidenced by a decrease in pH. A correlation was observed between decrease in strength on ageing of plywood bonded with alkali-catalysed phenolic acid and increase in alkalinity of the panel.

The susceptibility of Birch wood itself to attack by acids and alkalis was determined in order better to understand the mechanism of the deterioration of resin-bonded plywood. A marked decrease in strength occurred when the pH of the wood was lowered below 2·0. In the range between pH 2·0 and 2·5, strong acids, such as hydrochloric and sulphuric, had a more pronounced deteriorating effect than weak acids, such as hypophosphorous and nitranilic. A marked decrease in strength of the Birch also occurred when the pH was raised to 8·8 by the absorption of an alkali, tetraethanol ammonium hydroxide. *Author's summary.*

[2381]. 33.15.5 : 33.15.1. BABCOCK, C. E., and SMITH, A. K. **Extending phenolic resin plywood glues with proteinaceous materials.** *Industr. Engng. Chem.* (*Industr. Ed.*) 39 (1), 1947 (85–8). P.R.

Describes the proper type of resins for use in combination with protein materials such as corn gluten, soybean meal and linseed meal, for making plywood glues and gives formulae for suitable proportions. Describes the proper conditions for using the glues and discusses and tabulates test results of shear values and curing times on hardwoods and softwoods.

[2382]. 33.15.5 : 34.6 : 33.32.1. **Development and testing of adhesives.** *Rep. For. Prod. Aust. 1946-47*, 1947 (41).

Experiments have been completed at the Division of Forest Products, on the use of plywood adhesives made from potato starch. Strongest joints were obtained with mixtures containing relatively little alkali and water but the viscosity of these glues was higher than those commonly used for plywood. Preliminary investigations have been made on the possible use of various lignins as extenders for synthetic-resin adhesives.

[2383]. 33.15.5 (431–5). OXNAM, J. S. **Starch and starch adhesives industry in Western Germany.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 1559, Item No. 22, 1946. pp. 22. P.R.

Includes a section on wood-cellulose-base adhesives made from shredded wood paper, and used as a substitute for potato-starch-base adhesives.

[2384]. 33.15.5. **Fortified glues.** *Sci. Amer.* May, 1946 (203). P.R.

The usual glue solution is made resistant to moulds and bacteria by adding 0·5 per cent. by weight of an organo-mercuric fungicide to the dry glue. One side only of the assembly is treated with a dilute formaldehyde solution before joining with the matching wood surface to which a film of the glue has been applied in the usual way. These glues were developed in U.S.A. during the war for use in areas of high humidity and temperature.

33.17. Sawmilling

[2385]. 33.17. STRAUSS, C. **Good lumber from small sawmills.** *Sth. Lumberm.* 175 (2201), 1947 (119–22).

[2386]. 33.17 (485) : 09.4. COLLINDER, S. Sågverksrörelsens omfattning och produktion. [**Sawmilling and sawmill production [in Sweden].**] *Skogen* 35 (2), 1948 (17–19). [Sw.]

Statistics for 1945–46 of saws producing for the home market and for export, with their output in stds.

[2387]. 33.17 (941) : 82 : 98. HARTLEY, A. E. **Development trends in the Western Australian hardwood industry.** *Aust. Timb. J.* 13 (9), 1947 (566–7, 570, 611–12).

The part played by sawmills in the exploitation of the Western Australian forests and in the timber trade as a whole is discussed. A mill site has to be chosen with due regard to economy of transport, water supply, topography and labour problems. Its permanency depends on the rational exploitation of the forests on a sustained-yield basis. The present low recovery (between 30 and 40 per cent.) now makes it more profitable to convert timber near the stump, but the future exploitation of low-grade coal in the Collie area to provide electric power may cause a greater concentration of sawmills at or near towns. [Cf. *For. Abstr.* 9 (No. 2295).]

[2388]. 33.17 : 02.1 : 07.7. FOYSTER, J. R. **Modern mechanical saw practice.** Crosby Lockwood & Son, Ltd., 20 Tudor Street, London. 1947. pp. 274. Price 18*s*.

A detailed study of saws and sawing technique, with chapters on:—preliminary experiments, dealing with the cutting edge of saw teeth, penetration, the action of saw teeth and their angles, and mechanical parts of the saw bench; saw running; saw maintenance; science applied to sawing; and new methods of using saws. An appendix includes data on saw setting, the speed of saws, and comparative saw gauges. There are 158 photographs and diagrams.

[2389]. 33.17 (213) : 07.7. CHIPP, W. F. **Sawmilling in the tropics.** *J. Oxf. Univ. For. Soc.* (*3rd Ser.*) No. 2, 1947 (24–40).

Deals with location and size of mills, power, lay-out, engines, saws, benches, shafting, belting, setting and maintenance of saws, sawing procedure, and log pond or yard.

[2390]. 33.17 : 07.7. **Sawing of small dimensionally cut stock from small and faulty logs [methods and equipment].** *Tech. Notes For. Comm.* (*Div. Wood Technol.*), *N.S.W.* 2 (3), 1947 (1–3).

[2391]. 33.17 : 82 (471). MERILUOTO, M. Sahojen työntutkimus. [**Work studies in sawmilling.**] *Papp. Trävarutidskr. Finl.* 29 (17), 1947 (246, 248–53). [Fi.e.] P.R.

An account of time studies of log frame-sawing undertaken in 1946 in the group of mills affiliated to the Central Association of Finnish Woodworking Industries with a view to establishing a uniform scale of wages. The analysis established optimum rates for feeding logs of different sizes, the rate in ft. per min. being shown on a curve as a function of the girth, for 4 different classes of frame-line saws.

33.3. *Chemical Treatment*

See also *For. Abstr.* 9 (No. 2327).

[2392]. 33.3 : 31.3. GUILLEMONAT, A. Le bois, matière première de la chimie moderne. [**Wood, raw material of the modern chemical industry.**] Dunod, 92, rue Bonaparte, Paris. 1942. pp. vi + 135. [F.] L.S.

A book dealing with the structure of wood and its constituents—cellulose, lignin, hemicelluloses, polysaccharides, pectins, resins, essential oils, tannins, colouring matter and other minor constituents. Methods of preparing cellulose, polysaccharides and lignin are briefly described and separate chapters are devoted to methods used in the wood carbonization, wood hydrolysis and pulping industries.

Use of Wastes

[2393]. 33.3 : 34.6. OSTROWSKI, H. J. **A recovery system for chemical and groundwood screenings.** *B.C. Lumberm.* 31 (11), 1947 (58–9, 68). Also in *Pulp. Paper Mag. Can.* 48 (13), 1947 (88–90).

Description of the system in force in a British Columbia pulp mill for the utilization of rejected material from the screeners and knotters; this is collected in a large pit in the middle of the mill and manufactured into mill wrapper, core stock, and chipboard, the last-mentioned product being used as a filler in kraft laminating. Diagrams of the lay-out are given.

[2394]. 33.3 : 34.6. ENKVIST, T. Några erfarenheter vid prövning på flyktiga svavelföreningar i sulfatterpentin. [**Results of experiments on unstable sulphur compounds in sulphate turpentine.**] *Papp. Trävarutidskr. Finl.* 29 (3), 1947 (38–44). [Sw.e.] P.R.

Various samples of crude or only incompletely purified sulphate turpentine were analysed for their content of methyl mercaptan, methyl sulphide and methyl disulphide by simple tests applied directly to the turpentine solution, using solutions of the sulphur compounds named, in pure turpentine, as a check. Analyses of samples from different stages of the sulphate pulp cook showed that the main portion of the sulphur compounds appears in the turpentine after the temperature has reached its highest point.

[2395]. 33.3 : 34.6 : 01.4. SPRENGLING, G. R. **Improved methods of analysis for tall oil.** *Papp. Trävarutidskr. Finl.* 29 (9; 12), 1947 (124–6, 128, 130; 165–6). [E.] P.R.

[2396]. 33.3 : 34.6 : 01.4. YORSTON, F. H. **The analysis of sulphite waste liquor.** *Pulp Paper Mag. Can.* 48 (13), 1947 (74–80).

The analytical methods described include several new processes developed at the Pulp and Paper Research Institute, Montreal.

[2397]. 33.3 : 34.6. HATCH, R. S. **Recovery of chemicals and energy in the**

sulphite process through the use of magnesium as a base. *Pulp Paper Mag. Can.* 48 (13), 1947 (85–7).

[2398]. 33.3 : 34.6 (431–5). SAEMAN, J. F., and LOCKE, E. G. **Production of vanillin from sulfite waste liquor.** *FIAT Final Rep. Brit. Intell. Obj. Sub-comm.* No. 448, 1945. pp. 15. P.R.

No vanillin had yet been produced in Germany on a commercial scale from sulphite waste liquor. Plans were in progress by which 3 firms would combine to produce vanillin by the strong-alkali cleavage of sodium lignosulphonate. Continuous operation in a copper reactor is one of the key points in their method; the copper is claimed to have a catalytic effect resulting in the production of 20 per cent. more vanillin and the consumption of less alkali. Details of the production operation and production cost estimates are given. *From authors' summary.*

[2399]. 33.3 : 34.6 : 33.39. SUNDMAN, J. Sockerbisulfit och löst bunden svaveldioxid. **[Sugar bisulphite and loosely combined sulphur dioxide.]** *Medd. Industr. CentLab., Helsinki* No. 49, 1947. pp. 25. [Sw.sw.e.] P.R.

Discusses and tabulates the results of experiments on sulphite waste liquor to ascertain the quantities of SO_2 in combination with the sugars of the liquor, the effect of sugar-bisulphite combinations on fermentation, and the factors (kind of sugar, temperature and pH) affecting the constant of dissociation of sugar bisulphites into sugar and HSO_3.

[2400]. 33.3 : 34.6 : 33.39. SUNDMAN, J. Sockerarterna i sulfitavluta. **[The kinds of sugar in sulphite waste liquor.]** *Medd. Industr. CentLab., Helsinki* No. 50, 1947. pp. 14. [Sw.sw.e.] P.R.

Describes a new method used to determine the various sugars present. In the sulphite waste liquor from Spruce, mannose predominates; galactose is present in strong-pulp waste liquors, but is destroyed in rayon-pulp liquor during the cooking process; the presence of glucose in strong waste liquor cannot be proved. Fermentation of sulphite waste liquor will always be inferior to that of pure glucose solution because both mannose and galactose are less easily fermented than glucose.

[2401]. 33.3 : 34.6 : 11.47.1 : 11.42.2. FULLER, J. E. **Influence of purified lignin on nitrification in soil.** *Science* 104 (2701), 1946 (313–5). O.R.S.

The presence of purified lignin in sandy-loam soil reduced the amount of nitrate nitrogen recovered from dried blood and ammonium sulphate. The effect was much more marked with dried blood.

33.32. Pulp and Paper Manufacture. Wallboards. Plastics

See also *For. Abstr.* 9 (Nos. 2274, 2312).

[2402]. 33.32 : 02.1. GRANT, J. **Wood pulp and allied products.** Leonard Hill Ltd., 17 Stratford Place, London, W.1. 2nd ed., 1947. pp. xvi + 312 + plates. O.R.S.

A book dealing with all the most important aspects of pulping. A historical summary of the industry and a study of the nature of the wood fibre introduce chapters under the following heads:—identification and evaluation of pulping woods, preparation of wood for pulping, the mechanical process, the sulphite process, alkaline processes, bleaching, mechanical purification and de-watering, by-products, testing methods (physical and chemical) and uses of the pulp.

[2403]. 33.32 (431–5). FRANKEL, T. H., *et al.* **Chemical processes in relation to pulp and paper treatment. (Interrogation of Dr. Hermann Wenzl.)** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 1500, Item No. 22 [1947]. pp. 38. P.R.

[2404]. 33.32 (431–5) : 33.33. BRIDGE, F., COTTRALL, L. G., BATE, S. C., EVERETT, J. C., BERRY, W., and HALL, E. F. **Matters relating to the production of paper pulp and other allied matters. Interrogation of Prof. G. Jayme.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 1561, Item No. 22 [*n.d.*], pp. 30 + 6 dgms. + 2 gphs. P.R.

The report is divided into four sections comprising: (1) factors affecting the strength of pulp and paper; (2) the relationship between the various strength properties of paper and the properties and characteristics of the ultimate fibres; (3) the production of pulp from wood and straw by different methods; (4) wood-pulp developments in Germany with reference to pulps suitable for the viscose industry.

[2405]. 33.32 (52). SEIDL, R. **The wood pulp industry of Japan.** *Rep. Brit. Intell. Obj. Sub.-comm.* No. B.I.O.S./J.A.P./P.R./1434, 1946. pp. 27 + tbls. + plate. P.R.

Cf. *For. Abstr.* 9 (No. 404).

[2406]. 33.32 (82) : 31.2 : 09.4 : 98.1. TORTORELLI, L. A. Los bosques argentinos en la industria del papel de diarios. [**The Argentine forests in the newsprint industry.**] [*Publ.*] *Inst. Frut. Silv. B. Aires* 1 (3), 1943. pp. 58 + plates. [Span.span.e.port.]

The physical requirements of wood for good newsprint pulp are discussed and the properties of some indigenous and exotic species are described and tabulated. Of the indigenous species *Arancaria angustifolia* and *A. araucana* are highly suitable for chemical pulping, laboratory experiments having shown that a yield of 55·72 per cent. can be obtained from *A. angustifolia* and 60·4 per cent. from *A. araucana*.

A discussion of the geographical distribution and amounts of suitable timber available is included. It is estimated that Argentina imports 136,000 tons of newsprint annually, 27,000 tons being chemical pulp and the rest mechanical pulp. According to these figures the country could supply itself with enough chemical pulp to last 18 years by exploiting *A. angustifolia* forests; reforestation with this species at the rate of 23,000 ha. annually would give, at the end of 10 years, enough pulpwood to meet Argentina's needs in perpetuity.

The Paraná delta has various species suitable for mechanical pulp. The existing stands of *Salix alba* var. *caerulea* could supply the nation's total needs for 10 years and reforestation of 5,000 ha. annually would ensure a sufficient supply of mechanical pulp to meet her long-term needs.

The Italian hybrid *Populus* 'A.M.' grows as quickly in the Paraná delta as in Italy and, suitably planted and managed, could be an important source of mechanical pulp. [Cf. *For. Abstr.* 7 (No. 609).]

Lonchocarpus albiflorus, *Nectandra angustifolia*, *Bastardiopsis densiflora* and *Ocotea lanceolata* are also suitable species for mechanical pulping and existing forests could supply 1,100,000 tons, or 10 years' supply.

[2407]. 33.32 : 12.25 : 12.26–8 : 12.29. DUPONT, E., and ESCOURRU, R. Essais de cuisson de diverses matières cellulosiques—palmier nain, zizania, sarments, parasolier, fromager, pin. [**Pulping experiments on various cellulose-containing materials—Dwarf Palm, Zizania, Vine twigs, Umbrella tree, Kapok tree, Pine.**] *Chim. et Industr.* 47 (4), 1942 (470–4). [F.] D.S.I.R.

Pulping experiments were made with Dwarf Palm (*Chamaerops humilis*), Vine twigs, Umbrella tree (*Musanga smithii*), Kapok tree (*Ceiba pentandra*) and Maritime Pine (*Pinus pinaster*) using the soda process (with and without pressure), the sulphite process and the nitric acid process of Dupont and Escourru. Details of the processes and resultant types of pulp are tabulated. No satisfactory pulp was obtained from *C. humilis*, but a considerable yield of sugars by the nitric acid process. *C. pentandra* and *M. smithii* produced good quality pulp when treated by the soda process (with pressure) and a less satisfactory one under the nitric acid process. *M. smithii* gave a good, easily bleached pulp on digestion with calcium bisulphite and the process may be of interest in the French colonies in view of the difficulty of preparing caustic soda solutions and treating waste liquors there. Vine twigs proved of little value. *P. pinaster* is already known to give good results with the soda or sulphate processes. Experiments with the nitric acid process and *P. pinaster* proved of little interest. In cooking with bisulphite of soda, however, the presence of sodium ions facilitates the extraction of the resin. [Cf. *For. Abstr.* 9 (Nos. 398, 399).]

[2408]. 33.32 : 12.26–8 (73) : 34.24. FOREMAN, L. F. **Kraft pulping of southern hardwoods.** *Paper Mill News* 69 (40), 1946 (74). D.S.I.R.

Summarizes results of an investigation into the kraft pulping characteristics of 59 southern hardwoods; most of these were species containing tannin in either wood or bark, chosen because they could be used both for tannin and pulp production. The species showing most promise for pulp are: Swamp Red Oak [*Quercus falcata* var. *leucophylla*], Swamp Spanish Oak [*Q. f.* var. *pagodaefolia*?], Wild Olive [*Osmanthus americanus*], Scarlet Oak [*Q. coccinea*], Yaupon [*Ilex vomitoria*], Pin Oak [*Q. palustris*], Southern Red Oak [*Q. falcata*], Loblollybay [*Gordonia lasianthus*] and Laurel Oak [*Q. laurifolia*]. The most suitable dual-purpose

species is apparently Coastal Chinkapin [*Castanea* sp.] with a 12-per-cent. tannin content in both bark and wood, but the physical properties of the pulp are inferior to those of the hardwoods listed above.

[2409]. 33.32 : 12.26–8. SCHAFER, E. R. **Aspen for pulp and paper.** *Lake St. Aspen Rep.* No. 14, 1947. pp. 10. Also in *Pulp Paper Mag. Can.* 48 (13), 1947 (104, 106, 108–9).

A review of the present state of knowledge on the pulping qualities of *Populus tremuloides*, and the results obtained from various processes.

33.32.1. *Pulp Manufacture*

[2410]. 33.32.1 : 07.7. LOGAN, K. C. **New developments in the sulphite pulp industry.** *Pulp Paper Mag. Can.* 49 (1), 1948 (78–82).

Report of the 1947 Sulphite Committee, Technical Section of the Canadian Pulp and Paper Association. Among the subjects reviewed are screening systems and pulp drying and finishing.

[2411]. 33.32.1. HAUN, J. C. **Pitch removal from pulpwood.** *U.S. Patent* No. 2,423,020, June 24, 1947. *Chem. Abstr.* (17), 1947 (5721). P.R.

Proposes a method for adjusting the moisture content and removing the pitch and resin from logging slash to render it more suitable for sulphite pulping. The solvent used is an equal mixture of H_2O with acetone containing 10 per cent. of carbon tetrachloride by volume.

33.32.2. *Paper Manufacture*

[2412]. 33.32.2 (431–5) : 07.7. CREMER, H. L., FRANKEL, T., and ROUGH, W. **German papermaking industry.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 312, Item No. 22 [*n.d.*], pp. 110. P.R.

Describes the manufacturing methods and machinery used at 11 paper mills and at the Institute of Papermaking, Darmstadt. The report includes reproductions of advertising pamphlets issued by the different firms, statistics of types of paper produced and exports and imports, particulars of costs, and diagrams of machines used.

[2413]. 33.32.2 (431–5). KERN, F. S., and GILLANDERS, E. C. **Paper pulp moulding industry in Germany.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 1589, Item No. 22, 1947. pp. 17. P.R.

Describes methods of pulp preparation and consistency control, and the moulding machines used by 2 firms manufacturing containers for cleansing powders. The normal pre-war furnish was 75 per cent. mechanical and 25 per cent. sulphite pulp, but the one firm left in production now uses a large proportion of low-grade wood and straw-board waste.

33.32.3. *Wallboards, Fibreboards, etc.*

See also *For. Abstr.* 9 (No. 2334).

[2414]. 33.32.3 : 38.2. **Fibre building boards.** Building Boards Joint Committee, Melbourne House, Aldwych, London, W.C.2. 1947. pp. [ii] + 62 + plates + app.

An account of the properties and uses of insulating boards, wallboards, and hardboards with details of their rôle in building construction. Technical data required for such constructions are summarized in appendixes.

[2415]. 33.32.3 (431–5). WINSLOW, C. P., DICKERMAN, G. K., and SAEMAN, J. F. **Resin filled fibreboard of the Holig Homogenholzwerke.** *FIAT Final Rep. Brit. Intell. Obj. Sub-comm.* No. 572, 1946. pp. 14 + 2 dgms. P.R.

Describes the plant and the processes of fibre production, beating, and addition of resin of the phenol-formaldehyde type, in the manufacture of stabilized fibreboards and moulded products; but states that there is nothing new in the process. A translation of the makers' statement on the product and its properties is included in an appendix.

[2416]. 33.32.3 : 12.25. GRAHAM, R. D. **The effect of refining time and hot-pressing conditions on the properties of Lodgepole Pine fiberboard.** *Abstr.* of thesis, in *J. For.* 45 (10), 1947 (761). [Oregon State College.]

33.33. Manufacture of Textiles from Wood

See also *For. Abstr.* 9 (No. 2404).

[2417]. 33.33 : 12.25. PHRIX-ARBEITSGEMEINSCHAFT. **Chemical pulp from Pine wood suitable for the manufacture of artificial fibres.** *Belg. Patent* Nos. 448,957 and 448,959, Feb., 1943. *Chem. Abstr.* 41 (19), 1947 (6408). P.R.

(1) The raw material is hydrolysed with dilute H_2SO_4 (0·2–0·6 per cent.) above 100° C. and is treated wet by the sulphate process. (2) The raw materials are treated hot in an acid medium and subjected to strong mechanical disintegration before treating by an alkaline process.

33.36. Wood Finishes. Preservation of Wood. Seasoning and Drying

See also *For. Abstr.* 9 (Nos. 2224, 2274).

[2418]. 33.36 : 12.25. WEBER, P., BROEKER, J. F., BROWNE, F. L., GARLOCK, N. B., MACGUFFIE, J., PETERSON, E. P., and WERTHAN, S. **Round table discussion on painting of Southern Yellow Pine.** *Circ. Ga. Engng. Exp. Sta.* No. 14, 1947. pp. 19. D.S.I.R.

Considers the merits and shortcomings of Southern Yellow Pine for painting, the effect and treatment of resins and knots, and the use of primer, and discusses experiments carried out at Madison on the modification of the wood surface for painting.

[2419]. 33.36 : 31.2. BROWNE, F. L. **Wood properties and paint durability.** *Misc. Publ. U.S. Dep. Agric.* No. 629, 1947. pp. 10.

The influence of the density and texture, resin, oil and moisture content and of knots and other defects of wood upon its painting characteristics are discussed. Recommendations are made for selecting woods for painting by species, by grade, by kind of grain and by density and texture, with suggestions for painting the heavier softwoods.

[2420]. 33.36 : 31.8. **British standard specification for knotting.** *Brit. Stand.* No. 1336, 1946. pp. 7. P.R.

Relates to the constitution, qualities and application of the lac or resin (synthetic or natural) to be used as an impervious covering for knots and other resinous areas liable to stain superimposed paint.

33.36.1. *Preservation against Attack by Plants and Animals*

See also *For. Abstr.* 9 (Nos. 2252, 2272, 2274–5, 2278–9, 2284–5, 2338).

[2421]. 33.36.1 : 31.42.11 : 11.16.1. MACDONALD, J. A. **Experiments on the effect of centimetre-length electromagnetic waves on wood-destroying fungi.** *Ann. appl. Biol.* 34 (3), 1947 (430–4). O.R.E.

In an attempt to devise a practical method of killing wood-destroying fungi, mycelia of *Coniophora puteana* and *Merulius lacrymans* were exposed to the beamed radiation from a standard Service radar transmitter, transmitting pulses of wave-length 9·1 cm. Exposures up to 1 hour did not kill the mycelium of either fungus when growing on malt agar slopes or plates, or on wood blocks. The only obvious effect was a check in growth whenever drying of the mycelium occurred. *From author's summary.*

[2422]. 33.36.1 : 12.26–8 : 31.22.3. **The preservative treatment of Eucalypt true-wood.** *Rep. For. Prod. Aust. 1946–47*, 1947 (34–6).

A satisfactory penetration of the heartwood of many Eucalypt timbers was obtained by the Division of Forest Products, by using pressures of about 1,000 lb./sq. in. for both oil- and water-soluble preservatives. Only small specimens were used and further experiments are being undertaken with larger ones. The installation of a high-pressure cylinder big enough to treat with creosote full-sized sleepers is planned.

A study of treatment by diffusion yielded no method economically superior to the well known 'fluorizing' process. Fundamental diffusion studies have been continued in connexion with other applications. The diffusion rates of boric acid and salts through the sapwood and heartwood of 5 important Queensland timbers (now being commercially treated with boric acid against *Lyctus* attack) was examined. Difficulties experienced in the treatment of quarter-sawn boards are explained by the fact that radial is 2–3 times as fast as tangential diffusion. The diffusion rate of boric acid is faster than that of sodium fluoride.

A study of the diffusion of electrolytes in the timber is being carried out.

[2423]. 33.36.1 : 33.31. SCHULZE, B. **Protection of wood against destruction by animal or vegetable agents.** *Belg. Patent* No. 449,703, March, 1943. *Chem. Abstr.* 41 (20), 1947 (6664). P.R.

The wood is impregnated with an aqueous solution or paste of K bifluoride (10–25 per cent.) and/or NH_4 bifluoride (3–10 per cent.).

[2424]. 33.36.1 : 33.31 : 33.52. **German wood preservative substitute.** *Chem. Industr.* 58 (6), 1946 (1046–7). L.S.

'Flunax', a wood preservative used by the Germans during the war as a substitute for creosote in treating railway sleepers, consisted of 84 per cent. sodium fluoride, 8 per cent. xylenol and 8 per cent. caustic soda.

[2425]. 33.36.1 : 33.31 : 33.8. **Interim report on the underwater treatment of wooden and steel vessels.** *Inter. Rep. Stand. Ass. Aust.* No. S.A.A. Int. 221, 1947. pp. 14 + 4 plates. B.S.I.

Recommends the following treatments for the protection of wooden hulls against marine borers: (1) for slow heavy craft, a sheathing either of naturally resistant timber or of timber completely impregnated with a copper-naphthenate solution or creosote; (2) where applicable without detriment to weight and speed, copper sheathing; (3) impregnation of the hull with creosote or a copper-naphthenate solution; (4) as a temporary measure for fast-moving craft, several coats of copper-naphthenate solution and 2 final coats of a copper marine-growth-inhibiting paint; (5) for fast moving craft, painting a hard-setting bakelite plastic on the underwater parts.

Recommendations for inhibiting marine growth are also given [pp. 3–6, 11–12].

[2426]. 33.36.1 : 33.31 : 33.54. HARKOM, J. F., and SEDZIAK, H. P. **Laboratory and service tests of pentachlorophenol and copper naphthenate as wood preservatives.** *Mimeo. For. Prod. Lab., Can.* No. 126, 1947. pp. 11 + 2 tbls. P.R.

Gives results to date on some accelerated laboratory tests of pentachlorophenol and copper naphthenate, and details of the treatment of material for service tests. Red Pine pickets were used and pressure-treated.

Under the conditions of the laboratory tests and with the solvents used, less copper naphthenate than pentachlorophenol was removed from the treated wood blocks in heating and leaching cycles. After passing through such cycles the blocks treated with copper naphthenate showed more resistance to decay than those treated with pentachlorophenol.

The results of the tests are tabulated and discussed. Service tests have been initiated and the results of these and of other tests on full-sized treated timber products should give the final answer as to the value of pentachlorophenol and copper naphthenate as wood preservatives. *From authors' summary.*

[2427]. 33.36.1 : 31.42.12 : 33.31. VERRALL, A. F. **Keep sapstain control dips up to strength.** *Sth. Lumberm.* 175 (2168), 1947 (36).

A number of laboratory and field tests were made, to determine how far chemical solutions for the control of sapstain become weakened owing to the greater absorption of chemical than of water. Experiments were made with 'Lignasan' (ethyl mercuric phosphate), 'Dowicide G' and 'Santobrite' (sodium pentachlorophenate), mixtures of each of these alone with borax, and a triple mixture containing mercurial, chlorophenate, and borax. The results showed that:—(1) mercurial solutions may be much reduced in strength during dipping; (2) chlorophenolic solutions appear to be very little weakened with use; (3) mercurial + borax mixtures lose strength more slowly than the mercurial alone, but still at a rate that may affect commercial stain control; (4) mixtures of chlorophenates and borax, or mercurial, chlorophenate and borax, are intermediate in losing strength, and the rate of loss is probably not of commercial importance. All tests were made on Pine heartwood, and it is possible that other woods may have a different effect on the weakening of sapstain dips. It is recommended that, in order to secure consistent stain control, the vat should never be allowed to get below 80 per cent. of its full working volume and the solution used for replenishing should be of the same strength as that originally used. This procedure is specially necessary with mercurials, but should also be followed with chlorophenates. Vats should be drained and cleaned at 1- to 3-week intervals.

[2428]. 33.36.1 : 31.43. TESCH U. STABENOW INTERNATIONALE GESELLSCHAFT FÜR SCHÄDLINGSBEKÄMPFUNG M.B.H., HAMBURG. Verfahren zur Bekämpfung von holzzerstörenden Insekten durch Einführung von Imprägnierflüssigkeiten unter Gasdruck in Bohrlöcher. **[Control of wood-destroying insects by the introduction of impregnating liquids into auger holes under gas pressure.]** *German Patent* No. 721,778, June 18, 1942. pp. 2. *Bibliogr. sci. industr. Rep.* 5 (9), 1947 (827). D.S.I.R.

[2429]. 33.36.1 : 31.43 : 33.31 : 41. SIMPSON, L. J. **Control of borers in logs with D.D.T.** *Bi-m. Progr. Rep. For. Insect Invest. Dep. Agric. Can.* 3 (5), 1947 (1).

For previous report, see *For. Abstr.* 8 (No. 2141). Further tests suggest that the protection afforded may vary greatly, according to the number of borers in the area. It appears that good protection may be obtained so long as borers are not abnormally numerous.

[2430]. 33.36.1 : 31.43 : 13.2. **Treatment schedules for some Queensland timbers susceptible to attack by *Lyctus*.** *Aust. Timb. J.* 13 (6), 1947 (381, 407).

[2431]. 33.36.1 : 33.31 : 31.43 : 13.2. WOLCOTT, G. N. **The permanence of termite repellents.** *J. econ. Ent.* 40 (1), 1947 (124–9). [Univ. of Puerto Rico Agric. Exp. Sta., Rio Piedras.]

The woods treated were temperate-zone woods susceptible or very susceptible to attack by the W. Indian dry-wood termite, *Cryptotermes brevis*. Many inorganic chemicals used at great dilution, and all organic chemicals tested, showed initial toxicity lasting a few months only. Zinc and copper fluorides were as permanently repellent as zinc chloride and copper sulphate respectively, used at 10 times the strength. Wood submerged in a 1-per-cent. solution of DDT in benzol was attacked by termites in little more than a month's exposure to air, but 2-per-cent. DDT gave protection for nearly 3 years; 0·5-per-cent. pentabromophenol protected wood for only 2 weeks, but the sample impregnated with 1-per-cent. pentabromophenol was still uneaten by termites 2 years later. Tectoquinone at 0·2 per cent. was effective for a month and a half, and 0·2-per-cent. xanthone for 2 months, but the wood samples submerged in 0·5-per-cent. solutions of these chemicals had not been eaten after more than a year. Dilutions of 0·1 per cent. of lead and sodium pentachlorphenates, and of pyridimercuric chloride and stearate, were effective for less than a month, but 0·2-per-cent. solutions of these chemicals gave protection for a year or more.

[2432]. 33.36.1 : 31.43 : 13.2 : 33.31. HUNT, G. M., and SNYDER, T. E. **An international termite exposure test—eighteenth progress report.** *Pests* 15 (7), 1947 (12–20). D.S.I.R.

Tabulates the inspection results of sapwood Pine stakes, treated with 15 different chemicals, after 17–18 years' service, subject to termite attack, at the Barro Colorado Island test station, at Canberra, Australia, at Honolulu and at Pienaars River Experiment Station, Transvaal, and of specimens after 5–15 years' service, subjected to termite attack, at the Barro Colorado Island Station. [Cf. *For. Abstr.* 2 (No. 777).]

33.36.3. *Seasoning. Drying*

See also *For. Abstr.* 9 (Nos. 2326, 2338, 2357).

[2433]. 33.36.3 : 07.7. IHNE, A. Séchage des bois. [**Timber seasoning.**] Dunod, 92 Rue Bonaparte (vi), Paris. 1947. pp. 285. [F.f.] Fourth edition, revised by A. VILLIÈRE. P.R.

A full account of the theory and practice of seasoning, with detailed accounts of different methods of air and kiln drying and the use of radio-frequency. [Cf. *For. Abstr.* 2 (85).]

[2434]. 33.36.3 : 31.22.1 (73). PECK, E. C. **Moisture content of wood.** *Wood Prod.* 52 (11), 1947 (29–30).

General principles of wood seasoning, with two maps showing average moisture contents of interior woodwork in the U.S.A. in relation to (*a*) average temperatures in January, (*b*) average minimum relative humidity in July.

[2435]. 33.36.3 : 33.92 (76). SMITH, W. R. **How do we dry lumber?** *Sth. Lumberm.* 175 (2199), 1947 (47, 50, 52).

The results of a survey of seasoning and storage practices in the South-eastern United States. Particular attention is given to faulty lay-out of air-seasoning yards and improper stickering, which cause much waste of timber. The advantages of roofing lumber piles are emphasized.

[2436]. 33.36.3. ESPENAS, L. D. **Air seasoning of lumber.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1657, 1947. pp. 6 + 1 tbl. P.R.

General rules for piling lumber for air seasoning, with sections on site, alleys, foundations, piling, stickers, board spacing, flues and chimneys, roofs and sheds.

[2437]. 33.36.3 : 33.7 : 31.23 : 31.22.1. Toma, G. T. Variația greutății lemnului de foc a doua și a treia serie de cercetări. **[Variation in the weight of firewood: 2nd and 3rd investigations.]** *An. Inst. Cerc. Exp. for., București 1944–45*, 10, 1946 (75–102). [Rum.g.] P.R.

The results of an earlier investigation were published in 1938. The present studies, based on green wood in stacks measuring 3–5 × 1 × 1 m., yielded the following results: Firewood cut in summer or winter can be regarded as dry in the following summer at earliest, by which time Black Alder will have 60–65 per cent., Fir and Lime 60–70 per cent., Beech 75 per cent., Pedunculate and Turkey Oak about 80 per cent. of green weight. A table gives percentage decrease in weight after 3, 6, 9, 12, 15, 18 and 23 months respectively for these species. Relative humidity and temperature of the air influence the weight of wood, but only slowly. A stacked cubic metre of round billets weighs more than one of cleft wood, and the thicker the billets, the greater is the discrepancy. Round wood also dries more slowly than cleft. This is because the bark on the round wood delays evaporation of the moisture in the wood. In the case of Beech, however, this difference applies only to the first 6 months, after which, the thin bark having dried, round wood dries quicker than cleft. Pedunculate Oak is less durable than Turkey Oak, and begins to decay early in the second year after cutting. The softer species of wood lose much more moisture than the harder; thus a stacked cubic meter of Lime or Alder can lose as much as 250 kg. of water in the first year, while the maximum loss from either species of Oak is not more than 140 kg.

[2438]. 33.36.3 : 33.38.2. Bobkov, A. Estestvennaya sushka drevesinȳ—osnova podgotovki gazogeneratornogo topliva. **[Air-drying of wood—a basic principle in the preparation of producer-gas fuel.]** *Lesnaya Prom.* 1947 (7), (11–13). [Russ.]

By 1950 it is planned to convert 70 per cent. of the vehicles used for forestry work in the U.S.S.R. to operation by producer gas. In view of this, the author examines the possibility of saving expense by air-drying producer fuelwood, and concludes that if felling and conversion are done before the period of active drying, and if the wood is properly prepared (cleft and completely or partially barked), air-drying within one summer season is possible in all regions of the country and should be the standard method. Each producer-fuel centre should develop its own drying schedules according to species used and local climate.

[2439]. 33.36.3 : 12.26–8. Torgeson, O. W. **Kiln-drying schedules for 1-inch Laurel, Madrone, Tanoak, and Chinquapin.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1684, 1947. pp. 8 + 6 tbls. + 8 plates + 4 gphs. P.R.

Describes methods of obtaining the recommended schedules, which are given in tables and graphs.

[2440]. 33.36.3 : 07.7 : 12.26–8. **Kiln drying and chemical seasoning.** *Rep. For. Prod. Aust. 1946–47*, 1947 (27–30).

Studies on Satinay (*Syncarpia hillii*) and Brush Box (*Tristania conferta*), made by the Division of Forest Products, indicate that kiln drying of selected 2-in.-thick Brush Box is a commercial possibility for certain uses, though the species is very variable. Drying characteristics of Satinay are much the same, though, in general, distortion is rather less and collapse and checking rather greater. Quarter-sawing is more important with Satinay. Pre-treatment of back-sawn material with sodium chloride gave promising results.

Work on *Eucalyptus sieberiana*, *E. eugenioides* and *E. capitellata* (Silvertop Ash, White Stringybark and Brown Stringybark) showed that back-sawn material needs special pre-treatment to avoid checking, but commercial kiln drying of quarter-sawn material is feasible.

The development of a drying technique for 'Ash'-type Eucalypts was undertaken and results indicate that collapse in these species is the cause of both primary and secondary seasoning difficulties. The production of high-grade plywood from these species requires a combination of rotary-peeled core stock with sliced veneer for the faces.

A pre-drier for sorted timber has been designed by the Division of Forest Products. It provides economic initial drying, from the green state to a moisture content of about 25 to 30 per cent., for hardwoods destined for subsequent kiln drying, and is intended to help to improve output in areas which have extended periods unsuitable for air drying. Boiler-exhaust-flue gases are used as the heating

medium. The drier takes multiple charges 8 ft. high and 35 ft. long.

[2441]. 33.36.3 (81) : 31.22.2. BROTERO, F. A. Secagem da madeira em estufa. [**Kiln-drying of timber [with some data on shrinkage of 94 Brazilian woods].**] *Bol. Inst. Pesqu. tech. S. Paulo* No. 27, 1941. pp. 47 + plate. [Port.] P.R.

[2442]. 33.36.3 : 07.7. TORGESON, O. W. **Small demountable type lumber dry kiln for experimental drying.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1671, 1947. pp. 5 + 2 dgms. + 2 plates. P.R.

Describes a kiln designed at the Forest Products Laboratory principally for use in the field and having automatic-control equipment and a maximum capacity of about 1,000 bd. ft. of 1-in. lumber. It is emphasized that construction of a kiln should be treated as an engineering problem, and sufficient details are not given for construction of the kiln by persons inexperienced in this field.

[2443]. 33.36.3 : 07.7. BURNS, A. F., and HYDE, W. S. **Gas-fired lumber drying kilns.** *Sth. Lumberm.* 176 (2203), 1948 (72, 74).

Describes a system of kiln-drying lumber, using natural gas, at Little Rock, Arkansas.

[2444]. 33.36.3 : 07.7. KIMBALL, K. E. **Temperature measuring and controlling devices in lumber dry kilns.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1654, 1947. pp. 13 + 12 dgms. P.R.

Describes various types of instruments for measuring and controlling temperature, with their relative advantages and defects, and discusses their optimum position in the kiln.

[2445]. 33.36.3. ISHAQ, S. M. **High frequency drying of wood.** *Rep. U.S. For. Prod. Lab., Madison* No. *R*1681, 1947. pp. 9 + 3 tbls. + 1 dgm. + 7 gphs. [Forest Research Institute, Dehra Dun.] P.R. See also *Sth. Lumberm.* 175 (2201), 1947 (163–9).

Discusses the theory of high-frequency drying and describes, with graphs and tables, the results of tests on small blocks and boards of Douglas Fir and Yellow Birch, a few blocks of Eucalyptus and Pochote, and on pencil slats of California Incense Cedar. It is concluded that drying of wood by this method is limited by the rate at which moisture evaporated from the material can escape at the existing temperature. In the case of impervious woods like Eucalyptus, severe end, surface, and internal checks occurred; the pencil slats also suffered from checking, twisting, and warping. The blocks and boards of Douglas Fir and Yellow Birch, however, dried satisfactorily.

[2446]. 33.36.3. STEINWAY and SONS. **Electrostatic treatment of wood.** *Brit. Patent* No. 585,591, May, 1944. *Brit. Abstr.* BI, 1947 (216). P.R.

Wood for soundboards is baked continuously or successively at 375–425° F. in a high-frequency electrostatic field for sufficiently long (10–30 min.) to remove some of the oleoresins and at least some of the combined H_2O in the cellulose. A part of the wood surface may be cooled between successive bakings so as to maintain a temperature differential of 15–30° between inside and outside of the wood.

33.37. Distillation. Manufacture of Tar

[2447]. 33.37. PRAT ROURE, L. DE. Procedimientos modernos para la obtención de los subproductos de la destilación de leñas. [**Modern methods of obtaining by-products from the destructive distillation of wood.**] *Montes, Madrid* 3 (15), 1947 (226–33). [Span.]

33.38. Charcoal Manufacture. Use of Wood and Charcoal in Producer-gas Generators

See also *For. Abstr.* 9 (No. 2438).

[2448]. 33.38.1 : 12.29. MUKHERJEE, S., and BHATTACHARYYA, S. **Preparation of activated charcoal from Bamboo.** *J. sci. industr. Res., India* 6 (1), 1947 (8–9). I.H.

Activated charcoal prepared from *Melocanna bambusoides* and *Dendrocalamus strictus*, using acidulated zinc chloride for pre-digestion, was found to possess high adsorptive potency. No great difference was observed between charcoals prepared from nodes and internodes, or between the thick and the thin varieties. Use of calcium chloride instead of zinc chloride increases the adsorption of caramel but reduces the adsorption of methylene blue, iodine and acetic acid. *From authors' summary.*

33.39. Manufacture of Sugar, Oils, Alcohol, and Miscellaneous Chemical Products from Wood

See also *For. Abstr.* 9 (Nos. 2398–2400).

[2449]. 33.39 : 33.1 : 34.6. HARRIS, E. E. **Wood-sugar molasses from wood waste.** *Sth. Lumberm.* 175 (2201), 1947 (157–61).

A process has just been developed at the Forest Products Laboratory, Madison [cf. *For. Abstr.* 9 (p. 396)], by which 150 to 190 gal. of molasses can be produced from 1 ton of wood. Wood waste—sawdust, slabs, edgings, cull trees, waste wood from turpentine and resin solvent extraction etc.—is pressure cooked with dilute acid, and the resulting sugar solution is evaporated to a molasses suitable as a substitute for blackstrap molasses in cattle food and as a source of glucose for many industrial purposes. Sawdust alone in the hydrolyser tends to pack into a mass through which the acid flows with difficulty and is apt to disintegrate into even finer particles which a filter may not hold, but up to 40 per cent. of sawdust can be included in a charge. Larger forms of wood waste must be converted to chips about $\frac{3}{8}$ in. long. Yield of sugar depends on the amount of cellulose in the wood and varies with species. Redwood, having a high lignin content, produces little sugar, while Aspen gives a high yield. The inclusion of bark, rotten wood, or wood that has been pre-treated with steam or water also reduces the sugar output. The value and use of the molasses also varies with the type of wood. Softwood molasses consists largely of hexoses and is more valuable for industrial processes, such as alcoholic fermentation and for feeding pigs, horses or other animals which can assimilate hexose sugar but not pentoses. Hardwood molasses contains larger amounts of pentose sugars. Either type can be used to produce fodder yeast and for fermentations producing butyl alcohol, butyric acid, or 2-3 butylene glycol. It is also suitable for food for cattle, sheep and other cud-chewing animals which, it is believed, can digest hexoses and pentoses equally well. The pilot-plant and process are described. By-products are lignin and bark for fuel, furfural, methanol and acetic acid. An estimation of expenses shows that, assuming a return from the by-products, 1 ton of molasses should cost \$11.70 to \$16.10. The process is thought to be of particular importance now that more efficient processes for sugar recovery from cane are coming into use, and the supply of blackstrap molasses is likely to decrease.

[2450]. 33.39 : 33.1 : 34.6. HARRIS, E. E. **Alcohol from Douglas-Fir wood waste. III. Utilization of wood waste.** *Timberman* 49 (4), 1948 (68,70, 72, 74, 76).

The third of a series of articles [cf. *For. Abstr.* 8 (No. 525)] on results of experiments at the Forest Products Laboratory on the production of sugar and alcohol from wood waste. One ton of dry Douglas-Fir mill waste (a mixture of sawdust, slabs, edgings, and shavings, including about 25 per cent. bark) can be hydrolysed to produce 750–800 lb. of sugar dissolved in about 8 tons of water, and 700 lb. of lignin (dry basis), plus about 15 lb. of furfural and 10 lb. of methanol. The lignin may be used as fuel for the processing plant, or briquetted and sold for domestic fuel. The lignin from one ton of mixed wood waste can be carbonized to produce 445 lb. of charcoal and 35 lb. of settled tar; hydrogenized to produce 500 lb. of such products as phenols, resins, high-boiling alcohols and hydrocarbons; or oxidized with nitric acid to produce about 950 lb. of crystalline oxalic acid.

[2451]. 33.39 : 12.25 : 12.26–8. HARRIS, E. E. **Production of alcohol from Australian woods.** *J. Coun. sci. industr. Res. Aust.* 19 (3), 1946 (303–10). *Repr. For. Prod. Aust.* No. 92. [Cf. *For. Abstr.* 9 (No. 447).]

[2452]. 33.39. HARRIS, E. E., HANNAN, M. L., and MARQUARDT, R. R. **Production of fodder yeast.** *Paper Tr. J.* 125 (22), 1947 (34–7). P.R.

Torula utilis yeast was grown on the wood sugars in wood hydrolysates and in sulphite waste liquor. Yields were 32 to 53 per cent. of the sugar utilized. About 94 per cent. of the total reducing material calculated as glucose in wood hydrolysates and up to 79 per cent. in sulphite waste liquor could be utilized by yeast. A light-coloured yeast was obtained from both wood hydrolysates and unevaporated sulphite waste liquor. *Authors' summary.*

33.4. *Converted Structural Timber*

See also *For. Abstr.* 9
(Nos. 2261, 2350, 2364, 2505–07, 2512–14).

[2453]. 33.4 (431–5) : 07.7. WILSON, T. G., and MOSESSON, T. J. **German wooden door industry.** *Final Rep. Brit. Intell. Obj. Subcomm.* No. 1568, Item No. 22 [*n.d.*], pp. 11 + plates + 2 dgms. P.R.

Plants visited could be grouped in 2 categories: the laminated-wood specialists, which war needs have developed into large modern industries; and the small traditional woodworking plants. The latter are remarkable for their ability to produce good products cheaply and with economy of timber, in old, badly equipped shops. Methods and machinery of 2 modern plants, one producing flush doors from veneers on a core and the other dowelled panel doors, are described. No important new types of machine were met with, but a plug-boring-and-patching machine might be useful to firms outside Germany.

[2454]. 33.4 : 31.27 : 33.15.2. COOPER, K. L., and MACK, J. J. **Thinner floors.** *For. Prod. News Lett. C.S.I.R. Aust.* No. 157, 1947 (2–3).

Summarizes the results of tests on timber flooring carried out by the timber mechanics section of the Division of Forest Products. Conclusions drawn are (1) that floors made of plywood $\frac{5}{8}$-in. thick are sufficiently strong for domestic purposes; (2) that all of the 9 Australian hardwood species tested would give satisfactory service as strip flooring if only $\frac{9}{16}$ in. thick, on joists at 18-in. spacing.

33.5. *Pitprops. Sleepers. Poles and Other Roughly Converted Wood*

See also *For. Abstr.* 9
(Nos. 2270, 2424, 2426).

[2455]. 33.51 (410) : 31.27 : 31.8. ARMSTRONG, F. H. **The strength of home-grown timber pit-props.** *Forestry* 21 (1), 1947 (43–76 + plates).

Describes in detail a comprehensive investigation of the characteristic strength properties of seven species of British-grown softwood with reference to their use as supports in mines. Taking 2,650 lb./sq. in. as the accepted strength (based on top diameter) for Baltic Redwood, graded timber of three of the home-grown species, European Larch, Norway Spruce, and Douglas Fir, is superior to imported Redwood by about 7, 4, and 2 per cent. respectively, while Japanese Larch has about equal strength, and Scots Pine, Sitka Spruce and Corsican Pine are slightly inferior. Corsican Pine is little affected by grading and is about 10 per cent. inferior whether graded or not. The following general conclusions were drawn from the tests (which were all made on unseasoned material):—(1) A fairly close and definite relationship exists between prop strength and specific gravity, the strength increasing roughly in proportion to the increase in specific gravity. (2) The strength of the prop depends on the rate of growth, optimum growth conditions varying according to species. Within broad limits the rate of growth is an index of specific gravity. (3) Bow (initial curvature) affects strength and stiffness to a marked degree. (4) Knot-whorls are not of great importance, apart from considerations of appearance, ease of handling, etc. (5) The strength of whole props of each species, assuming a ratio of $L/D = 12$, is upwards of 80–90 per cent. of the maximum compressive strength of the clear timber of the same props. (6) The strength of a prop decreases as the slenderness ratio increases. When of good quality, most of the home-grown softwoods compare favourably in strength with material from the Baltic and elsewhere. Attention is drawn to the comparatively low strength of the poorer-quality material from wolf trees, and it is recommended that these should not be used for supports in the mines.

[2456]. 33.52 : 33.36.1 : 76.1. RIJN, J. VAN. **Sleepers: (*a*) different types; (*b*) maintenance methods; (*c*) financial comparisons. Special report.** *Mon. Bull. int. Rly. Congr. Ass.* (*Engl. Ed.*) 24 (4), 1947 (481–6). L.M.S. through D.S.I.R.

Summarizes reports made to the fourteenth session of the International Railway Congress Association, 1947, based on replies to questionnaires addressed to the railways of (*a*) America, Great Britain, India, Dominions, Protectorates and Colonies, China and Egypt and (*b*) Belgium and colony, Bulgaria, Denmark, Spain, Finland, France and colonies, Greece, Hungary, Italy, Luxembourg, Norway, Netherlands and

colonies, Poland, Portugal and colonies, Rumania, Sweden, Switzerland, Czechoslovakia, Turkey and Jugoslavia. Conclusions reached are that wooden sleepers both hardwood and softwood, are by far the most widely used, that metal sleepers, are preferable for the tropics, and concrete sleepers, though some types give good results, little used. In spite of initial lower costs, a softwood sleeper costs more per year of service than a hardwood one. Leaving aside countries rich in timber, the cost of impregnating sleepers is made good by their longer life. In steel-producing countries metal sleepers may compete in cost with wooden ones, and, though no definite figures are available, the annual cost of concrete sleepers, given careful manufacture and suitable methods of fastening, may be lower than either.

[2457]. 33.53 : 12.26–8. ANDERSON, I. V. **The merits of Lodgepole Pine poles.** *Sta. Pap. Nth. Rocky Mt. For. Range Exp. Sta.* No. 10, 1947. pp. 6.

33.6. *Packing Boxes, Crates, etc.*

[2458]. 33.6 : 33.15.2 : 12.26–8 : 31.27. KURTENACKER, R. S., and SKIDMORE, K. E. **Water Oak veneer for Southern citrus boxes.** *Sth. Lumberm.* 175 (2201), 1947 (312, 314, 316, 318–19).

Tests were made at the Forest Products Laboratory, Madison, on the suitability of Water Oak [*Quercus nigra*?] veneer for citrus boxes. Containers of the cleated-panel style were made, using $\frac{1}{6}$-in. and $\frac{1}{8}$-in. veneers cut both from a bolt without heating and from one heated to 160° F. Two methods of piling the veneers for drying were also used but neither this nor the temperature of the bolt at cutting had any significant effect on the results. It was concluded that the crates will give good service under normal conditions. The $\frac{1}{6}$-in.-veneer crates gave a slightly better performance than the $\frac{1}{8}$-in.-veneer, but the latter were about 2 lb. lighter and correspondingly lighter than the standard commercial boxes tested for comparison. Both the Water Oak boxes compared favourably with the latter, giving a better performance in the 'drop-cornerwise' test, but the commercial veneer boxes were better in the 'incline-impact' test.

33.8. *Other Manufactured Products*

See also *For. Abstr.* 9 (Nos. 2235, 2262, 2350).

[2459]. 33.8 (73) : 07.7 : 33.15.2 : 33.15.5. DRAKE, R. H. **Aircraft woodwork.** MacMillan Company, New York. 1946. pp. 197. Price $3.50. M.O.S.

A comprehensive work containing chapters on the use, selection, and defects of aircraft woods; the use of plywood; a glossary of aircraft woodworking terms; the use and interpretation of technical drawings; tools, glues and gluing, joints and laminations, and finishes; the construction of various aircraft parts, and approved repairs. Tables show the characteristics of some common woods, minimum requirements and defects of aircraft woods, the limits of rings per in. for spar stock, the minimum recommended bend radii for plywood and the characteristics of commonly used glues. There are 222 diagrams and photographs.

[2460]. 33.8 : 33.91 : 33.15.2. **British standard specification for aircraft material. Medium and low strength plywood for aircraft purposes.** *Brit. Stand.* No. V.35, 1947. pp. 16. P.R.

The specification is divided into 3 parts: species of timber and quality of veneer, with plates illustrating types and degree of defect; construction of boards, dealing with the assembly of veneers, edge joints, thickness, glue, scarf joints, manufacturing defects, moisture content, finish and marking; and testing, covering the selection of test samples, tests and re-tests.

[2461]. 33.8 : 33.15.2 : 12.25 : 31.27. VIEIRA, A. Contraplacado nacional para aviação. **[Plywood for aircraft from indigenous species.]** *Bol. Inst. Pesqu. tech. S. Paulo* No. 29, 1941 (19–29 + plates). [Port.] P.R.

Details of constructing plywood plates from *Araucaria angustifolia*, with tables showing their physical and mechanical properties.

[2462]. 33.8 (431–5) : 33.32.4 : 33.15.4 : 33.15.5. LEIGH, J. H., KING, E. P., and GORDON, J. E. **Developments in aircraft construction using plastic, paper, veneer, and thin metal in sandwich and other**

formations. *Final Rep. Brit. Intell. Obj. Subcomm.* No. 1494, Item No. 25, 1946. pp. 14 + 30 plates. P.R.

Describes visits paid to aircraft manufacturing firms and test laboratories. Among the materials used were Tronal, an expanded wood-waste material, and Polystal wood and wood/metal adhesives.

[2463]. 33.8 : 33.15.2. HARASTY, V. **Boat construction.** *U.S. Patent* No. 2,418,636, April 8, 1947. *Mod. Plastics* 25 (1), 1947 (140). P.R.

A boat consisting of a laminated wood keel composed of parallel wooden strips bonded by a cold-setting waterproof glue.

[2464]. 33.8 : 33.15.2. FULLER, P. **Compound curves in molded plywood now produced by mass-production methods.** *Plastics & Resins* 4 (11), 1945 (9–10, 32). P.R.

Describes, with diagrams, moulded plywood leg-splints supplied to the United States Navy for combat vessels, amphibious forces and landing craft. Advantages claimed are buoyancy, light weight, convenience in storing and handling, strength, and durability.

33.9. *Grading [including Standard Specifications] and Storage of Converted Timber*

See also *For. Abstr.* 9 (Nos. 2224, 2257, 2326, 2345, 2348, 2455, 2459–60).

[2465]. 33.91 (79) : 12.25. **Standard grading and dressing rules for Douglas Fir, Sitka Spruce, West Coast Hemlock, Western Red Cedar.** West Coast Lumbermen's Association, Portland, Oregon. 1947. pp. 8 + [3]. P.R.

[2466]. 33.91 : 33.15 (44) : 01.2. Bois contreplaqués. Terminologie. **[Plywood. Definitions.]** *Norme franç.* No. NF B50–004, 1945. pp. 2. [Fr.] P.R.

[2467]. 33.91 : 33.15 (44). Bois contreplaqués: dimensions des panneaux. **[Plywood: dimensions of panels.]** *Norme franç.* No. NF B54–006, 1945. pp. 2. [Fr.] P.R.

[2468]. 33.91 : 33.15 (73) : 12.26–8. **Hardwood plywood (third edition).** *Comm. Stand. U.S. Bur. Stand.* No. CS35–47, 1947. pp. 25. P.R.

[2469]. 33.91 : 33.15 (79) : 33.4. **Recommended minimum standards for design and fabrication of glued laminated structural softwood lumber.** West Coast Lumbermen's Association, Portland, Oregon. 1946. pp. [4.] P.R.

[2470]. 33.91 : 38.2 : 33.36.1. SILVESTER, E. D. **Stress grading—an important experiment in modern timber engineering.** *Wood* 13 (1), 1948 (12–16).

An account of the re-decking of the Thamesside Empire Wharf Jetty, in which the use of stress-graded timber effected a considerable economy in material. A safe working stress of 1,200 lb./sq. in. in flexure was adopted and it was found that instead of the ungraded 6 × 12-in. beams used in the original structure, it was possible to obtain the requisite strength with 5 × 10-in. beams of graded timber. The thickness of the decking was similarly reduced from 3 to 2 in. All timbers were incised and impregnated with Tanalith salts. Illustrations show the process of selection of timbers as well as the actual construction.

34. MINOR FOREST PRODUCTS AND THEIR UTILIZATION

[2471]. 34 (667). COLLINS, W. B. **Rural industries in the Gold Coast.** *Emp. For. Rev.* 26 (2), 1947 (263–7).

Describes the various rural and cottage industries of the Gold Coast, most of which have some relation with the forest or forest products—making of palm wine, pit-sawing, roofing, wood carving, weaving of mats, cloth, and silk, rubber collection, pottery and bee-keeping.

34.2. *Vegetable Products*

See also *For. Abstr.* 9 (No. 2100).

34.24. Tanning Materials. Cork. Bark Products

See also *For. Abstr.* 9 (Nos. 2327, 2408).

[2472]. 34.24 (73). BANDEKOW, R. T. **Present and potential sources of tannin in the United States.** *J. For.* 45 (10), 1947 (729–34).

[2473]. 34.24 : 12.26–8 (45) : 44.3. GIORDANO, G. Les extraits tanniques de bois de châtaignier. **[Tannins extracted from**

Chestnut wood.] *Rev. Bois Appl.* 2 (5), 1947 (7–14). [Université forestière de Florence.] P.R.

Discusses the production in Italy of tannin from Chestnut (70,000 tons as against 13,500 from other trees), the machine methods of extraction, the necessary quality of wood, the distribution and extent of Italian Chestnut stands and the common diseases which attack them.

[2474]. 34.24 : 12.26–8 : 45.3 : 12.26–8 : 13.2. Bodeanu, M. Conținutul coltanilor in substanțe tanante. [**Tannin content of galls on acorns, caused by *Cynips calicis*.**] *Rev. Pădurilor* 62 (7/9), 1947 (109–18). [Rum.f.]

Analysis of a large number of galls from various parts of Rumania gave a mean value of 26·07 g. per 100 kg. green material. It was found that the tannin content increased in proportion to the area of the acorn covered by the gall, reaching a maximum when the acorn was completely covered.

[2475]. 34.24 : 12.26–8. **Cork, an international product, plays big role in modern life.** *Foreign Comm. Wkly.* 30 (2), 1948 (3–5, 35).

A brief account of the sources of supply of cork in the Mediterranean basin, production methods, statistics of American imports, and description of some of the uses to which it is put.

[2476]. 34.24 (431–5). Perkins, J. B., Mays, E. G., and Neville, K. **German cork industry (natural and composition) for bottle closures, etc.** *Final Rep. Brit. Intell. Obj. Sub-comm.* No. 1540, Item No. 22, 1947. pp. 17. P.R.

Sixteen factories were visited, 3 of which were outstanding for equipment and methods. Supplies of cork-wood were very small and production therefore low; substitute materials were uneconomic and unsatisfactory.

[2477]. 34.24 : 12.26–8 (469) : 12.11.3 : 21 : 23.3. Chesneau. Le chêne-liège au Portugal. [**The Cork Oak in Portugal.**] *Rev. Eaux For.* 85 (8/9; 10), 1947 (504–16; 585–603). [F.]

A general account of afforestation in Portugal during the past few decades, and the work of the Alcobaca Cork Oak Research Station. Among the subjects dealt with are genetics and methods of harvesting.

[2478]. 34.24 : 12.26–8 : 12.11.11 : 34.25. Meijer, T. M. **The constituents of the bark of *Diospyros maritima* Bl.** *Rec. Trav. chim. Pays-Bas* 66 (3/4), 1947 (193–8). [E.] [Laboratory for Chemical Research, Buitenzorg.] O.R.S.

34.25. Christmas Trees. Medicinal and Edible Plants

[2479]. 34.25 (711). **B.C.'s new plan of farming—Christmas trees.** *For. Topics* No. 2, 1947. pp. 3.

[2480]. 34.25 : 12.25.2. Cope, J. A. **Christmas tree farming.** *Amer. Forests* 53 (12), 1947 (544–6, 569).

Account of the methods of planting, tending, and harvesting Spruce (*Picea abies* and *P. glauca*) and Scots Pine grown for Christmas trees. If Christmas trees are to be taken out as thinnings, an initial spacing of 4 × 4 ft. is suitable; after half the trees are taken out, there would still be a substantial plantation left. For successive crops of Christmas trees on the same land, the spacing can be 5 × 5 or 6 × 6 ft. If it is intended to grow a second crop from the stumps, the wider spacing is essential. In this case, at least two whorls of live branches are left, which will turn up, and by the second year the best of the branches can be selected to shape into a new tree. It is emphasized that trees must be pruned in order to produce first-class Christmas trees capable of competing commercially with wildings; customers willingly pay extra for the more symmetrical product.

[2481]. 34.25 : 12.25 : 2. Wellner, C. A., and Roe, A. L. **A pictorial account of management practices for Christmas tree production in Douglas-Fir stands of the Northern Rocky Mountains.** *Sta. Pap. Nth. Rocky Mt. For. Range Exp. Sta.* No. 9, 1947. pp. 21.

[2482]. 34.25 : 12.25. **To reduce fire hazard, stand Spruce and Balsam Fir Christmas trees in water.** *Sth. Pulp Paper J.* 10 (12), 1947 (24).

The recommended procedure is:—(1) Obtain a tree that has been cut as recently as possible; (2) cut off the end of the stem diagonally at least 1 in. above the cut end, stand the tree at once in a container of water and keep the water level above the cut surface.

[2483]. 34.25 : 12.26–8 : 12.11.11. MEIJER, T. M. **Chemical constituents of *Mundulea suberosa* Benth. Part I.** *Rec. Trav. chim. Pays-Bas* 66 (3/4), 1947 (177–83). [E.] [Laboratory for Chemical Research, Buitenzorg.] O.R.S.

A review of literature on the occurrence and uses of *Mundulea suberosa*. Chemical investigation of the branch bark led to the isolation of rotenone and a white substance $C_{23}H_{20}O_7$, melting-point 193–195° C. From the root bark a yellow substance $C_{23}H_{20}O_7$, melting-point 216–220° C. was isolated. Both products contained two methoxyl groups. *From author's summary.*

[2484]. 34.25 : 12.26–8 : 12.11.11. LOUSTALOT, A. J. **A semi-quantitative quick test for determining quinine in Cinchona bark.** *Proc. Amer. Soc. hort. Sci.* 48, 1946 (386–90). E.M.B.

[2485]. 34.25 : 12.29 (91). SALVERDA, Z. Groot-exploitatie van Sago. **[Large-scale exploitation of Sago.]** *Tectona* 37 (5/6), 1947 (115–26). [Du.e.]

34.26. Resin. Turpentine. Gums. Latex. Dyestuffs

[2486]. 34.26 : 01.6. **Selected publications of the naval stores research division on production, properties and uses of naval stores (turpentine, rosin, Pine gum, etc.).** Naval Stores Research Division, Bureau of Agricultural and Industrial Chemistry, U.S. Department of Agriculture. 1946. pp. 16.

[2487]. 34.26 (46) : 92 : 98.3 : 35. LORENTE, V. La ordenación de la industria resinera. **[The organization of the resin industry.]** *Montes, Madrid* 2 (12), 1946 (534–40). [Span.]

An account of the decree of March, 1945, by which the Spanish resin industry was organized on a national basis. The practice of selling by auction, consequent fluctuations of prices and irrational distribution of processing plants were all factors causing confusion and inefficiency. By the 1945 decree, a controlling organization, the Junta Intersindical de Resinas, was set up and began to formulate a national plan. This divides the country into zones, each to be served by a chosen factory. Companies which have to close down or move will be compensated. No new factory may be set up without reference to the plan. Owners will still be responsible for tapping their own trees, but may waive their rights if they choose, in which case the forests will be worked by the local factory under the direction of the Junta Intersindical. Distribution and marketing, both for national and foreign markets, will be organized by a body named Comercial de Resinas, which will control prices and allocate profits.

[2488]. 34.26 : 12.25 (45). GIACOBBE, A. La resinazione dei pini in Italia. **[Resin-tapping of Pines in Italy.]** *Riv. ital. Essenze* 29 (3), 1947 (77–8). [It.] L.S.

Gives a brief account of the two methods of resin-tapping chiefly used in Italy: (1) the Hugues or 'landes' method with a single channel, lengthened every few days and working from the base upwards; (2) the herring-bone system of shallow incisions, working down the trunk. The second, which is more intensive than the Hugues method 'à vie', though less intensive than the Hugues method 'à mort', is specially suitable for application in mountain territory or to species not very rich in resin, or in places where the summer is short and the nights relatively cold.

The four principal resin-producing companies work some millions of trees in Italy: *Pinus sylvestris* in Lombardy and some of the Alpine valleys, *Pinus nigra* var. *austriaca* in the south and Sicily, and *Pinus pinea* on the Tuscan coast, are worked by the herring-bone method; *P. maritima* on the Tuscan and Ligurian coasts, *P. halepensis*, and *P. pinea* in other areas, are worked by the Hugues method.

[2489]. 34.26 : 12.25 (596–9) : 63. MAURAND, P. Le gemmage des pins en Indochine. **[Resin tapping of Pines in Indo-China.]** *Rev. int. Bois* Nos. 118; 120/1, 1947 (75–82; 123–33). [F.]

A detailed account of the methods of tapping and refining resin from *Pinus merkusii* stands in French Indo-China, and the system of management applied to these stands, which are poorly stocked, with a high proportion of very old trees. The (conversion) rotation has been reduced to 32 years, with the object of exploiting the stands (of only about 30 trees to the hectare) as quickly as possible, while extracting the maximum amount of resin, and replacing them by young stands of 700–900 trees to the hectare. It is calculated that at the end of 32

years, the first compartments would contain a young stand ready for tapping. It is assumed that trees are ready for tapping at 25–30 years of age (20 cm. diameter) and can be tapped at 4-yearly intervals up to 68 years, followed by 8 years' heavy tapping and 4 years' tapping to death.

A brief review of world production and exports of resin and the bearing of these on Indo-China's own prospects is included.

[2490]. 34.26 : 12.26–8 : 34.27. GHOSE, T. P., and KRISHNA, S. **'Gum taminda', a new substitute for gum tragacanth or Carob Bean gum.** *Indian Text. J.* 56 (666), 1946 (506–8, 561). L.S.

Tamarind seed pectin is already used for sizing and finishing in the Indian textile industry. [Cf. *For. Abstr.* 5 (54).] Gum taminda is produced by treating a concentrated aqueous extract of Tamarind seeds with borax. It has properties similar to those of Carob Bean gum and gum tragacanth, and should prove a successful substitute for them in most commercial applications.

[2491]. 34.26 : 12.26–8 (678) : 21.0. MOFFETT, J. P. **Papain production in Northern Tanganyika: method of obtaining and treating latex.** *Crown Colonist* 17 (192), 1947 (574, 576 + plates). O.G.

Papain, the dried latex from the fruit of the Pawpaw [*Carica papaya*] is now extensively used in the manufacture of medicines and cosmetics, for such processes as chillproofing beer, tenderizing meat, tanning leather, and degumming natural silk. There is a heavy demand and the price of the pure product is now 25*s.* per lb. Most of the 1945 production of 109,760 lb. came from Tanganyika, where the tree has been grown since 1935. A short-stemmed variety, making tapping easier, is now used. Notes are given on planting, espacement, etc., and the methods of tapping and preparing the latex.

[2492]. 34.26 : 12.26–8 (470). STRATONOVICH, A. I. Tselevŷe khozyaystva kak sredstvo skoreyshego sozdaniya sŷrevoy bazŷ dlya polucheniya guttaperchi. **[Special plantation areas as a rapid means of creating a supply of raw material for gutta percha.]** *Lesnaya Prom.* 1947 (6), (18). [Russ.]

In view of the increasing demand for gutta-percha and the diminishing resources, growing naturally under forest canopy, of the *Euonymus* species from which this product is obtained in Russia, cultivated open plantations have been tried, and with success. The advantages of the latter are that: (1) The rotation in open plantations is less than half that in natural underwood (8–10 instead of 20–30 years). (2) The yield may be 5–10 times as great, e.g. the average yield of roots per ha. is 200–300(–500) kg. in forests of the N. Caucasus, but as much as 5,000–8,000 kg. might possibly be obtained in plantations of *E. europaea*. (3) Mechanized cultivation and harvesting, intensive methods of growing, and selective breeding will be facilitated.

The author envisages the establishment of about 20 special large-scale plantation areas in the U.S.S.R., chiefly in central European Russia but also in the N. Caucasus, Altai, Urals and the Ukraine. It is provisionally estimated that a plantation area of 900 ha. should give an annual yield of 100 metric tons of material or 10 metric tons of gutta-percha. *E. europaea* is thought to be the most suitable species as it is readily cultivated and more productive than *E. verrucosa* in spite of having a rather lower gutta content. [Cf. *For. Abstr.* 7 (Nos. 1378–9).]

[2493]. 34.26 : 12.26–8. **Gifts of the Americas: Annatto.** *Agric. in Americas* 7 (8/9), 1947 [119]. A.P.B.

A short description is given of *Bixa orellana*, from which is obtained Annatto, a reddish-yellow dyestuff extracted from the seed pulp, with a brief summary of the history of the industry.

[2494]. 34.26 : 12.26–8 : 12.11.11. SODI PALLARES, E. **The structure of [nordine], the water-insoluble pigment of the bark of 'Sangre de Drago' [*Jatropha spathulata*].** *Arch. Biochem.* 10 (2), 1946 (235–45). [National Institute of Cardiology, Mexico City.] L.S.

34.28. Osiers. Bamboos

[2495]. 34.28 : 12.26–8 (492 : 489). BANG, S. Lidt om Piledyrkning i Holland og Danmark. **[Notes on Osier-growing in Holland and Denmark.]** *Dansk Skovforen. Tidsskr.* 32 (8), 1947 (161–75). [Dan.]

Before the war, Danish Osier-growers produced only 2-year-old rods for hoops on butter-casks, etc., but war brought a great demand for 1-year-old basket rods; in spite of the fact that Danish-grown material had been considered inferior for this purpose, it was the only material available. At present a reversion is taking place to the pre-war situation, though the market is still glutted with 1-year-old rods. Basket rods could no doubt be grown with advantage in Denmark, but the right species and strains are required, and these should be thoroughly tested before coming into general use. Hoops for casks will, however, remain extremely important and the state subsidizes the establishment of *Salix viminalis* plantations for this purpose. In this instance also, selection and breeding of suitable pure lines (practically non-existent in Denmark at present) is an urgent need.

Holland supplied about 80 per cent. of Danish imports of Osier rods in 1939, and in view of Dutch experience in Osier-growing the author made a tour of Holland in 1946 to study technique. Of about 10,000 ha. devoted to this crop in Holland, roughly one-third is used for producing basket rods and withes cut at 1–2 years of age, and the remainder for 3- to 4-year-old material from which fencing, poles, hoops, etc. are made. Great attention has been paid to the selection of suitable clones for different purposes and different soils and the purity of stocks is controlled by the Nederlandsche Algemeene Keuringsdienst [Netherlands General Plant Certification Service]. Much attention is also devoted to the thinning of all inferior shoots from the stools, a practice well worth imitating in Denmark. The Dutch use spacings of 50 × 60 cm. as compared with the Danish 20 × 60 cm. and the wider spacing is probably advantageous for all but Osiers destined for cutting at 1 year of age. Mixed plantations of different clones are regarded as some insurance against damage by fungi, insects, frost and other agencies. Much emphasis is also laid on proper fertilizing and this is a further problem which urgently requires solution for Danish conditions. [Cf. *For. Abstr.* 8 (Nos. 611–13).]

[2496]. 34.28 : 12.29 (52). COHEN, W. E. **Utilization of Bamboo in Japan.** Council for Scientific and Industrial Research, Melbourne. 1947. pp. 7. Typescript.

34.3. *Products of the Animal Kingdom*

[2497]. 34.3 : 13.2 : 13.15 : 45.3 : 12.26–8. MAHDIHASSAN, S. **Two neglected insect enemies of lac.** *Indian For.* 73 (10), 1947 (445–6 + plate).

During the monsoon season, *Shorea talura*, the host plant of the Mysore lac insect (*Tachardia lacca*), is infested by aphids, which are preyed on in turn by a *Chrysopa* (probably *C. khandalina*) larva and a Reduviid bug, which also feed on the larvae of the lac insect and considerably reduce the yield of lac. The *Chrysopa* larvae can be got rid of by beating the branches of the trees in the heat of the day.

35. SALE AND DISPOSAL OF FOREST PRODUCTS. TIMBER TRADE

See also *For. Abstr.* 9 (Nos. 2019–28, 2037, 2325–6, 2338, 2638, 2656).

[2498]. 35 (410) : 09.4. **Monthly Digest of Statistics,** No. 25, 1948. pp. iv + 136. **Definitions of Items and Units in the Monthly Digest of Statistics.** Revised Jan., 1948. pp. 44. H.M. Stationery Office, London. Cf. *Lon. Abstr.* 8 (No. 1360).

[2499]. 35 (46). MARTINEZ HERMOSILLA, P. La industrialización forestal: sus problemas actuales. [**Industrialization of the forests—present problems. [Recommendations for centralizing and stabilizing the Spanish forest products industry].**] *Montes, Madrid* 3 (16), 1947 (371–8). [Span.]

[2500]. 35 (52) : 98 : 09.4. ROSENBLATT. **Japan: lumber production and distribution.** *Rep. Brit. Intell. Obj. Sub-comm.* No. B.I.O.S./J.A.P./P.R./943, 1945. pp. 11. P.R.

Annual exports, imports, demand, production and stock in hand at the end of each year 1937–44, and lumber production in 1943–45 arranged by prefectures.

[2501]. 35 (213) : 98.3 (73). MCKELLAR, A. D. **Immense tropical hardwood forests await development.** *Foreign Comm. Wkly.* 29 (1), 1947 (3–5, 34–5). I.F.B.

The tropical hardwood forests of the world cover some 3,638,000,000 acres, or nearly half the world's forest area but are estimated to produce only about 9 per cent. of the world's

timber supply and 2 per cent. of the world trade in wood. The U.S.A. is probably the world's largest importer and consumer of tropical hardwoods (92 million bd. ft. in 1946). Imports of tropical hardwoods into America from 1937 to 1946 are given in detail, and the difficulties in the way of increased exploitation of tropical hardwoods are discussed. [Cf. *For. Abstr.* 9 (No. 2219).]

[2502]. 35 (66 : 67 : 69 : 88 : 596–9) : 09.1 : 09.4. TERVER, P. Le commerce des bois tropicaux: historique du commerce des bois tropicaux français. [**The trade in tropical timbers: history of the French trade in tropical timbers.**] *Bois For. Trop.* No. 3, 1947 (55–65). [F.]

A short account of the development of the French trade in tropical timbers with the French colonies in West Africa, Madagascar, Guiana and Indo-China, with tables of exports for 1913–45.

[2503]. 35 (691) : 91. FOURNOLS, J. La production forestière et l'économie du bois à Madagascar. [**Forest production and timber economy in Madagascar.**] *Bois For. Trop.* No. 3, 1947 (10–16 + plates). [F.]

[2504]. 35 (711) : 81. **The work of a forest ranger—timber sales.** *For. Topics* No. 1, 1947. pp. 3.

38. CONSTRUCTIONAL WORKS. ENGINEERING

See also *For. Abstr.* 9 (No. 2314).

38.2. *Building Construction. Foundations and Superstructures*

[2505]. 38.2 : 12.26–8 : 33.4. SUMP, A. W. **Aspen for cabin logs.** *Lake St. Aspen Rep.* No. 15, 1947. pp. 12.

[2506]. 38.2 : 31.27 : 33.4. ISAACS, D. V. **The structural sufficiency of domestic buildings.** *Bull. Commonw. exp. Build. Sta., Sydney* No. 1, 1946. pp. 50. P.R.

Considers some existing codes, and attempts, in a new tentative code, to strike the balance between caution and timber economy. There are sections on: superimposed loading and limiting deflections for domestic floors; live loading and limiting deflections for domestic roofs; walls and foundations; wind loadings for domestic structures; working stresses and test loadings; and recommended code for structural efficiency.

[2507]. 38.2 : 31.27 : 33.4. HOLE, F. G. **Sizes of timber in floors of domestic buildings.** *Bull. Commonw. exp. Build. Sta., Sydney* No. 2, 1946. pp. 15. P.R.

The sizes of timbers required to carry the loads set out in Bulletin No. 1, using the working stresses and limiting deflections specified therein, have been calculated for varying spans and spacings of bearers and joists, and the results tabulated.

[2508]. 38.2. HEYER, O. C., and WILSON, T. R. C. **Technique of house nailing.** House and Home Finance Agency, Washington, D.C. 1947. pp. 53. [Forest Products Laboratory, Madison.] P.R.

Fifty-two annotated diagrams, each representing one constructional detail of a timber house, showing the number and size of nails recommended, their placing and the direction in which they are to be driven.

[2509]. 38.2 : 31.42.11. DILLER, J. D. **Reduction of decay hazard in basementless houses on wet sites.** *For. Path. spec. Release U.S. For. Prod. Lab., Madison* No. 30, 1946. pp. 4. *Repr.* from *Amer. Builder.* P.R.

Results of tests carried out over a period of 5 years indicate that, in basementless houses, excessive moisture in joists or solid sills can be reduced and dangers of decay averted, by covering the soil under the house with a layer of asphalt roll roofing.

38.3 *Road and Bridge Construction*

[2510]. 38.3. GORMAN, A. **Forest truck road specifications.** *Misc. Ser. For. Serv. Can.* No. 5, 1945, pp. 11.

The specifications are intended to include the essentials that experience has shown to be necessary in the building of roads that will provide, within reasonable limits of cost, the service required for motor transport in the development and protection of forest areas. In addition to specifications, a general outline of building methods is given.

[2511]. 38.3 (73). SIMMONS, F. C. **Construction of all-weather roads.** *Sth. Lumberm.* 175 (2201), 1947 (282–3, 286, 288, 290, 292).

[2512]. 38.3 : 12.25 : 31.27 : 33.4. BOWMAN, H. L. **Report of tests on Douglas Fir balks for ponton bridges.** Drexel Institute of Technology. [*n.d.*] pp. 46. *Abstr.* in *Bibliogr. sci. industr. Rep.* 2 (11), 1946 (807). D.S.I.R.

The baulks were tested as beams, 3rd-point loading, mid-point deflection, and top fibre strains being measured. Specimens 8 in. long were cut from the end of the 40-in. sticks and tested in compression parallel to the grain. Some were tested dry, others after being soaked in water overnight. The remaining lengths were tested as beams in the same way as the baulks. The results of the tests are summarized in tables. The effect of moisture is shown in a separate table; a gain in moisture of 9 per cent. by weight appreciably decreases the strength and stiffness of the wood. However, it was not considered possible to correlate per-cent. increase in moisture with decrease in strength and stiffness, or specific gravity with strength. Graphs, tables and plates are included.

[2513]. 38.2 : 31.27. KEENEY, W. D., and SEILER, J. F. **Construction methods and their effect on composite bridge deck design.** *Wood Pres. News* 25 (8), 1947 (67–74). P.R.

Applies standard methods of analysis of the moments in continuous beams to the conditions obtaining in the course of constructing a composite concrete/timber bridge deck. The conditions during pouring of the concrete and also after the concrete has set have been analysed with particular reference to the effect of using temporary intermediate supports during the initial phase of construction. It is shown that under certain conditions such supports should lead to economy in timber.

[2514]. 38.3 : 33.4 : 31.27. SBURLAN, D. A. Contribuțiuni la studiul grinzilor principale de lemn pentru podurile de cale ferată îngustă (0·760 m.). [**Contribution to the study of main girders of wood in the bridges of narrow-gauge (0·76 m.) railways.**] *An. Inst. Cerc. Exp. for., București 1944–45*, 10, 1946 (3–44). [Rum.f.] P.R.

38.4. *Construction of Railways, Cableways, etc.*

[2515]. 38.4 (470). MARTŸNOV, N. V., and SŸROMYATNIKOV, S. A. Konno-dekoviľnŷe dorogi dlya vŷvozki i podvozki lesa. [**Horse-operated Decauville tracks for timber extraction and transport.**] *Lesnaya Prom.* 1947 (8), (18–23). [Russ.]

An official directive lays down that the minimum conditions for the use of Decauville tracks with horse-drawn wagons, are a growing stock of 100,000 cu.m. or more with annual felling and extraction of 25,000 cu.m. The present article tabulates in detail the basic conditions for the use of these tracks in timber extraction, together with specifications of sleepers, rails, their cost and the man-days required for laying them, the dimensions of points, timber wagons, etc.

38.6. *Drainage*

See *For. Abstr.* 9 (No. 2608).

4. FOREST INJURIES AND PROTECTION

[2516]. 4 (73). [WYCKOFF, S. N., HARTLEY, C., and ORR, L. W.] **Report 5 from a reappraisal of the forest situation: Protection against forest insects and diseases in the United States.** *Reappraisal Rep. U.S. For. Serv.* 1947. pp. ii + 39.

This study of the situation with respect to forest insects and diseases shows that, although they cause greater losses in standing timber than does fire, much less progress has been made in controlling them. The authors suggest necessary legislation, research, and organization necessary to reduce losses from these causes.

42. INJURIES FROM INORGANIC AGENCIES, EXCLUDING FIRE

42.2. *Temperature Influences*

See also *For. Abstr.* 9 (No. 2192).

[2517]. 42.21 : 12.11.21 : 21.8 : 11.11.2. CRANE, H. L. **[Factors influencing the] hardiness of woody plants.** *Amer. Nurserym.* 86 (10), 1947 (18, 20, 55–62) [Bureau of Plant Industry, Beltsville, Md.]

The factors discussed include length of rest period (period of true dormancy), alternations of temperature, the process of hardening off, defoliation, size of fruit or nut crop, freezing of ground water, and sunscald. The author cites observations made by himself on Orange trees in Georgia. A few hundred trees bore a heavy crop of fruit and, at the time of a sudden sharp frost in November, this had been completely harvested from some trees, partly from others, and not touched on most of them. All the trees from which no fruit had been harvested were killed to the ground. The trees from which part of the fruit had been harvested were defoliated, and all but the large limbs were killed. The trees from which all the fruit had been removed two weeks or more previously, were defoliated, but suffered little or no injury to the wood. The severe injury was probably caused because the materials making for hardiness had been transported to the maturing fruit.

[2518]. 42.21 : 12.25 (493) : 44.3. BOUDRU, M. La crise du pin laricio de Corse en Belgique. **[Pathology of Corsican Pine in Belgium.]** *Bull. Soc. for. Belg.* 54 (2), 1947 (49–94). [F.]

The abnormal mortality which has been reported for some years in stands of Corsican Pine [cf. *For. Abstr.* 8 (No. 2696)] is not fungal. The fungi which have attracted attention in the Campine region (*Dasyscypha calyciformis*, *Crumenula pinicola*, and *C. abietina*) by their frequency and abundance, are parasitic only on weakened or wounded trees. An anatomical study of necrotic tissues and field observations show that the primary cause of die-back is a frost injury: the present critical condition of Corsican Pine in Belgium is due to the exceptionally cold winters of 1939–40 and 1941–42. A comparison is made between the climate of the Campine and that of Corsica and Calabria. The average winter in the Campine is milder than that in the mountains of Corsica and Calabria, but temperature variations are much wider and the danger from frosts is consequently greater. The particular climatic factors unfavourable to Corsican Pine in the Campine were sudden sharp frosts following on mild autumns, when vegetative activity was still going on, and a series of severe winters. Frost damage, however, even when most severe, endangers the existence of these Pine stands only during a comparatively short period (from the 10th to 20th years). Moreover, abnormally severe winters occur in Western Europe in a fairly regular cycle; we are at present on the eve of a mild period which should be long enough to permit of re-establishing the plantations destroyed during the war, and there is no reason to give up planting Corsican Pine, though it would be prudent to mix it with broadleaved species.

[2519]. 42.21 : 12.25 : 45.3. GALOUX, A. Des organismes secondaires sur le pin de Corse à la suite des froids hivernaux. **[Secondary organisms on Corsican Pine, following severe winter cold.]** *Bull. Soc. for. Belge.* 54 (10), 1947 (357–9). [F.]

Some trees of Corsican Pine weakened by a series of cold winters, were attacked not by fungus disease but by various insects, e.g. *Pityogenes bidentatus* in the shoots, *Pissodes notatus* at the base of the twigs, and *Hylastes ater* in the roots.

42.3. *Precipitations*

[2520]. 42.32 : 12.25 (763). MUNTZ, H. H. **Ice damage to Pine plantations.** *Sth. Lumberm.* 175 (2201), 1947 (142–5).

An account of a survey made by the Southern Forest Experiment Station to study lean and breakages caused by ice storms in Pine plantations and natural stands of central Louisiana. Small trees recovered from lean, but often developed a sweep in the trunk. Trunk breakages below the live crown caused death; breakages within it often resulted in a lyre-shaped growth. Some figures showing percentages of different types of damage are given. No serious secondary damage by insects was discovered. Slash Pine appeared most susceptible to injury, e.g. in a 10-year-old mixed plantation 34 per cent. of Slash and only 5 per cent. of Loblolly Pine were damaged. Longleaf appeared to have sustained only slightly more damage than Loblolly Pine, its most serious damage being in the form of trunk breakage; severe lean was more common in Slash and Loblolly. The few Loblolly plantations in central Louisiana showed only minor damage, but natural Loblolly stands in the north of the State were damaged quite severely. Small trees, especially Slash Pine below 15 ft., suffered mostly from lean and in general recovered well; taller Slash Pines frequently broke and made a poor recovery from severe lean. Heavy damage occurred in both open-grown and dense stands, with the densest showing the highest percentage of loss. Observations in natural pole stands of Longleaf Pine demonstrated that where heavy commercial fellings of the larger trees had been made, the remaining smaller trees suffered badly. In order to minimize such damage, the stands should be lightly thinned after felling, taking mostly the smaller trees. Natural stands and plantations were equally susceptible. Most of the damaged trees can be salvaged, but at the cost of pulpwood volume and quality.

[2521]. 42.33 : 12.25 (931). **[Hail damage.]** *Rep. N.Z. For. Serv. 1946–47*, 1947 (24).

Young compartments of *Pinus radiata* still show the marks of stem and foliage damage from the storm of 3 years ago. On the windward side, the bark has not completely reformed over the countless small cicatrices caused by hailstones on young leaders, and deformities and foliage stripping are still in evidence. This type of minor damage, while not lethal, is very unsightly and retards growth. growth.

42.5. *Chemical Influences. Nutrient Deficiencies*

See also *For. Abstr.* 9 (No. 2558).

[2522]. 42.51 : 12.26–8. MILLER, V. L., JOHNSON, F., and ALLMENDINGER, D. F. **Fluorine analysis of Italian Prune foliage affected by marginal scorch.** *Phytopathology* 38 (1), 1948 (30–7).

A new non-parasitical disease of Italian Prune trees, characterized by marginal scorch and leaf spot, appeared in certain areas of western Washington. Chemical analysis showed that leaves of trees grown in the affected areas were abnormally high in fluorine as compared with leaf samples from other localities. The analyses of 6 samples collected 90 miles or more from an aluminium factory had a fluorine content of 6–15 p.p.m., while 76 samples from areas within 20 miles of an aluminium factory had a fluorine content varying from 30 to 1,400 p.p.m. Within a given area, the amount of marginal scorch was approximately proportional to the fluorine content of the leaves. Fluorine content returned to normal and marginal scorch of leaves did not occur during the growing season following the closing of the two aluminium factories in Tacoma and Troutdale, Oregon. The evidence indicates that some fluorine is stored in dormant twigs but is not translocated to any great extent into the growing leaves. *From authors' abstract.*

43. FOREST FIRES

[2523]. 43 (944). LUKE, R. H. **An outline of forest fire control principles for the information of New South Wales foresters.** Forestry Commission, N.S.W., 44 Margaret St. Sydney. 1947. pp. 43.

[2524]. 43 : 76 : 01.6. WATROUS, R. C. **Economic aspects of forest-fire protection and damage: a list of references.** U.S. Dep. Agric. Library List, No. 34, 1947. pp. 48.

This bibliography covers the last 50 years and is limited to references on losses that can be measured in terms of money, the recognition

of those losses, the relation between protection costs and potential damage, and statistics of public and private protective agencies. Articles on insurance and controlled burning are included only if they have a specific bearing on one of these phases of the subject.

43.0. *Predisposing Factors and Causes*

[2525]. 43.02 : 07.7. HIGGINS, H. G. **A note on the assessment of bush fire hazard with a suggested design for a simple 'hazardometer.'** *Repr.* from *J. Coun. sci. industr. Res. Aust.* 19 (3), 1946 (293–4). *Repr. For. Prod. Aust.* No. 91.

A type of wood hygrometer is described and illustrated, consisting of a strip of 2-ply wood attached at one end so that any bending can be observed on a dial face. The veneer with the grain parallel to the length of the strip is very thin; the other, with the grain at right angles, is much thicker. An elastic sealer is applied to the edges. The construction provides for a large movement of the indicator end of the strip along with a relatively slow rate of response to moisture changes; hence the apparatus should indicate changes in moisture content corresponding to those of small twigs in the forest.

43.1. *Protective Measures*

[2526]. 43.1 (78 : 79) : 94.3. BRADY, R. C. **A regional plan of fire protection for private industry in the Douglas-Fir region.** *Abstr.* of thesis, in *J. For.* 45 (10), 1947 (734). [Oregon State College.]

[2527]. 43.1 : 07.7. JEFFERSON, F. J. **The helicopter—a new factor in fire control.** *Fire Control Notes* 9 (1), 1947 (1–9).

A review of the development of the helicopter and its use in forest-fire detection and suppression by the U.S. Forest Service.

[2528]. 43.12 : 07.7. BEALL, H. W. **Smoke generators as aids to forest fire detection.** *For.-Fire Res. Leafl. For. Serv. Can.* No. 3, 1947. pp. 3.

An account of the use of army smoke generators for checking the efficiency of lookouts, determining visible-area coverage, and providing mock smokes for fire drills.

[2529]. 43.12 : 07.7. BEALL, H. W. **Coated-lens binoculars for forest lookouts.** *For.-Fire Res. Leafl. For. Serv. Can.* No. 4, 1947. pp. 3.

In order to determine whether the advantages of magnesium-fluoride coating of lenses in binoculars for forest-fire detection [cf. *For. Abstr.* 8 (No. 672)] were sufficient to warrant the cost of treatment, an experiment was carried out by the Dominion Forest Service during the 1947 fire season. It was concluded that such lenses have no advantage over uncoated ones in bright daylight with good visibility. In failing light, or when mist or smoke haze are present, detection of smokes is noticeably improved by the use of coated lenses. Their superiority is, in general, due to increased brightness of the image and is therefore most pronounced in unfavourable light. The use of coated-lens binoculars is recommended where the utmost efficiency in forest-fire detection is desired, and might be considered for other optical devices such as transit telescopes, which may be used in a poor light.

[2530]. 43.13 : 07.7. MOKEEV, B. Tushenie lesnÿkh pozharov s samoleta. **[Suppression of forest fires from aircraft.]** *Lesnaya Prom.* 1947·(5), (17–18). [Russ.]

Reference is made to the unsuccessful attempts of Serebrennikov and Nesterov to create fire-breaks and control fire directly by means of bombs containing chemical solutions. It is suggested that a more promising method should be the creation of fire-breaks, not closer than 5 m. to the front of the fire, by low bombing with small explosive bombs released from the plane at such a rate as to fall at intervals of 2·5–3 m., when the earth thrown up should form a continuous fire-break. Two parachutists could be dropped immediately afterwards to make good any small deficiencies in the line.

Experiments by Serebrennikov in the middle '30s showed that an excellent fire-break 4 m. wide is obtainable by placing small ground charges of 250–300 g. ammonal at a depth of 40 cm. and spaced 2·5 m. apart. This suggests

that a second method worth trying would be to drop parachutists armed with such charges.

[2531]. 43.13 : 32.95 : 07.7. EVERTS, A. B. **A skyline fire extinguisher.** *Timberman* 49 (2), 1947 (102).

Description of a fire extinguisher for use on a cableway, designed for the White River Lumber Co., Enumclaw, Washington. The unit consists of a 100-gallon pressure tank to which is attached a 15-lb. CO_2 fire extinguisher from which the inside siphon tube has been removed. The pressure tank and extinguisher are protected by heavy railroad steel. A basket is attached to hold hose, shovels, etc. The whole can be transported by cableway. It is intended to use it with a foaming agent.

[2532]. 43.13 : 41. RITTER, E. **The use of a wetting agent on a forest fire.** *Fire Control Notes* 8 (4), 1947 (32–3).

Report on the use of 'wet water' in fighting a strongly burning slash fire of about 35 acres in Rhode Island. Twelve hundred feet of fire edge was complete extinguished by about 400 gal. of water with a 1-per-cent. solution of wetting agent. Another 200 gal. of 'wet water' was used in back-pack pumps to extinguish spot fires. A further load of 450 gal. was used in mopping up for a width of 250 ft. along the whole 1,200 ft. fire edge plus an additional 1,500 ft. at the head. No further outbreak occurred.

An experiment was made to test the effect of a wetting agent on conserving water in short lengths of unlined linen hose. When an attempt was made to pump untreated water through 200 ft. of dry hose at a pressure of about 100 lb./sq. in., leakage was so great that the 40 gal. used failed to reach the nozzle, while the same quantity of water with a 1-per-cent. solution of wetting agent reached the nozzle and 15 gal. came through with considerable force.

[2533]. 43.13 : 41 : 07.7. EVERTS, A. B. **Foam.** *Fire Control Notes* 9 (1), 1947 (41–6).

A short review of the method of application and equipment necessary in the use of mechanical foam in forest-fire control. It is concluded that, having regard to the cost, foam should be of value:—(1) for use in back-pack cans, where the addition of foam solution will produce 32 gallons of foam; (2) for agencies which are charged with protection of rural buildings as well as forest; (3) for agencies which operate along main roads with heavy motor traffic where the danger of large petrol tank-lorries catching fire may be expected. Foam can be made to flow over burning petrol and bring it under control.

43.3. *Fire Damage*

See also *For. Abstr.* 9 (No. 2067).

[2534]. 43.3 : 12.25 : 31.42.11 : 31.43. MOLCHANOV, A. A. Bystrota razlozheniya sosnovogo i elovogo otpada. [**Rate of decomposition of dead trees of Pine and Spruce.**] *Dokl. Akad. Nauk S.S.S.R.* 56 (8), 1947 (869–72). [Russ.] D.S.I.R.

In order to discover how long wood in dead trees might be utilizable, studies were made on burns of various ages of both standing and fallen dead trees. Serious damage was initiated by boring insects, especially beetles, and fungus attack was first noted round insect galleries and cracks in the wood, beginning with blue-stain. Insect attack was more severe in standing dead trees than in fallen ones. Rot began to appear some 3 years after death, when small patches of decay were found in 7·5 per cent. of standing Norway Spruce trees and 3·5 per cent. of standing Scots Pine. Dead Spruce trees started to fall in considerable numbers 6 years after the fires and at 8 years about 60 per cent. of them had fallen, the thicker stems going first. The percentage of dead Spruce trees showing sporophores of *Lenzites saepiaria* was 7 per cent. on an 8-year-old burn, rising to 60–65 per cent. at 14 years. Between 16 and 20 years, sporophores of *Fomes pinicola* were abundant, while after 20 years decay was effected chiefly by bacteria and fungi such as *Omphalia campanella* and *Boletus felleus*. On Scots Pine, sporophores of *L. saepiaria* occurred 20–25 years after death and those of *Fomes pinicola* as late as 50–60 years. Scots Pine stems up to 16 cm. d.b.h. reached the crumbly-rot stage at 15 years, and those of 20–24 cm. at 40–50 years; thicker stems may continue sound up to 90 years, and sleepers are made from fallen stems that have lain for 40–50 years on the ground. The following table illustrates the progress of decay in the forest type *Pinetum hylocomiosum*:—

Years after death	Scots Pine		Norway Spruce	
	Sound	Crumbly rot	Sound	Crumbly rot
	Per cent.	Per cent.	Per cent.	Per cent.
5	75	4	57	3
10	69	10	35	13
15	64	17	21	42
20	60	25	12	75
25	56	33	7	88
30	52	39	4	95
35	48	44	1	99
40	44	50	0	100
50	36	58		
60	29	66		
70	21	76		
80	12	85		
90	2	36 [?]		
100	0	100		

In the *Pinetum callunosum* decay proceeded twice as fast; in the *Pinetum polytrichosum* 1·6 times and in the *Pinetum sphagnosum* 6 times as slowly. Spruce of small diameter decayed more slowly than thicker material, e.g. the percentage of sound wood 8 years after death was 50–60 for stems of 12 cm., 40 for those of 24 cm., and 20–30 for those of 44 cm. d.b.h.

44. DAMAGE BY HARMFUL PLANTS. VIRUS DISEASES

See also *For. Abstr.* 9 (No. 2003).

44.1. *Forest Weeds*

See also *For. Abstr.* 9 (No. 2209–10).

[2535]. 44.1 (485) : 09.7 : 23.13. ECKERBOM, S. Skogsbruket vid Rankhyttan. [**Forestry at Rankhyttan.**] *Skogen* 34 (24), 1947 (317–28). [Sw.]

An illustrated account, supplementing a previous article (*Skogen* 24 (18; 19), 1937) with notes on site conditions, treatment, changes in growing stock, and habit forms of the chief tree species present on this estate, which was taken over 25 years ago in a semi-devastated condition.

Mention is made of experiments on the use of chlorate to prepare sites for natural regeneration, for which it appeared that the effectiveness of chlorate treatment could be increased by a subsequent surface burn done at a time when fire is readily confined to the desired area. This treatment was useful for sites with a ground cover of *Vaccinium* spp. and *Ledum palustre*, which spread for the most part vegetatively; for land covered with *Calluna*, however, burning proved inadvisable, as it favoured recolonization by *Calluna* seedlings. Chlorate treatment combined with burning was also tried on drained peatland with scattered, stunted Pine. Results so far appear very promising: the ground flora has improved in composition and vigorous Scots Pine and Birch (including *Betula verrucosa*) seedlings have appeared. [Cf. *For. Abstr.* 9 (Nos. 2051–3).]

[2536]. 44.1 : 11.47.13. DEKATOV, N. E. Perspektivy stimulirovaniya rosta drevesnoy rastitel'nosti putem khimicheskogo vozdeystviya na pochvu. [**Prospects of stimulating the growth of woody vegetation by means of the action of chemicals on the soil.**] *Lesnaya Prom.* 1947 (6), (15–17). [Russ.]

Reference is made to improvements in agricultural crop yields, even on uninfected [healthy] soils, consequent upon the application of antiseptics such as chloropicrin, chlorine, carbon disulphide, formalin, and hydrochloric acid. It is claimed that, when applied in small doses, such substances stimulate useful soil micro-organisms, increase availability of nutrients and favourably influence the chemical properties of the soil.

In the forest, the high cost of fertilizers at present restricts their use to nurseries and plantations; for natural forest, the scattering of slash on poor sites, and slash-burning on the better ones, are effective and practicable measures. Any treatments involving only small applications per unit area, e.g. the use of bacterial fertilizers or herbicides, would naturally be of interest in the forest.

The present paper reports some results from trials of chlorates in forest nurseries, plantations and cleared sites, as well as under canopy, in the N.W. and S.E. of European Russia. After the leaching out of the toxic chlorate residues from the soil, artificial or natural seedling stands of various tree species showed considerable improvement (better root system and height growth, more branches, larger leaves and greater air-dry weight) as compared with controls. Shrubs on the treated areas were also stimulated. Deciduous species reacted most strongly; in a number of cases the height growth of Oak, Ash, Elm, *Acer platanoides* and *Caragana arborescens* was more than

doubled, and their total air-dry weight, air-dry weight of the aerial portions, and leaf size, were increased respectively 2·5–3, 4–5 and 1·5–3 times. Autumn turning of the leaves in treated plantations began later, and during the summer drought the leaves remained a healthy green when those on untreated areas had begun to yellow.

Coniferous species reacted less vigorously, especially Pine [*P. sylvestris?*] but even with Pine it was possible to increase diameter and height growth 50 per cent. and to double the air-dry weight by chlorate treatment.

After application of chlorates at high rates [not specified], increased growth was observed in sowings and plantings for several years. Smaller dosages (1–3 g./sq. m.) applied several days before sowing or planting, or just after sowing, gave improvements in growth during the first two years. A parallel treatment with ammonium sulphate at 30 g./sq. m. was much less effective.

Under mixed Spruce/hardwood stands, plots treated with chlorates at 3–5 g./sq. m. showed several times as much Spruce [*Picea abies?*] regeneration as controls; during the 5–6 years of observation these seedlings grew 3–4 times as fast and had longer and darker green needles.

Dosages of 1–2 g. chlorate per sq. m. soil cause no injury to trees or shrubs over 2–3 years old, provided that the solution does not touch the aerial portions of the plants. A spring treatment of the soil between rows in an Osier plantations, using potassium chlorate at 1 g./sq. m., increased the weight of the rods harvested by 30–40 per cent.

The effect of chlorates is an indirect one and is due to a hastening of the decomposition of plant residues, increase in microbiological activity and promotion of ammonification and nitrification, particularly the latter. Treated plots showed far higher nitrate contents than controls, and in most cases the nitrate content of the topmost 20 cm. of soil greatly exceeded its contents of ammonium compounds, whereas in controls the converse was true. This is an important fact, as Pryanishnikov has shown that in acid soils (and the majority of forest soils are acid) nitrates are the best source of N for plants.

Spraying with small amounts of chlorate in solution gave good control of herbaceous vegetation, suffrutices and young root suckers of trees. It is estimated that a spring spraying of weeds in a nursery with 1–3 g. chlorate per sq. m., several days before sowing or transplanting, saved between 30 and 50 man-days of weeding per ha. during the season. In the forest, 5 g./sq. m. destroys root suckers of *Populus tremula* and *Alnus incana*, and 3–5 g./sq. m. is sufficient to destroy *Vaccinium myrtillus* and ensure its absence for some years. Where perennial herbaceous weeds are present, however, use of small doses of chlorate may be inadvisable, as their growth may be stimulated.

As potassium chlorate is expensive, the most suitable chlorate for these purposes is probably that of calcium.

It is noted that increased nitrification in the soil has also been observed after applications of the water used for washing illuminating gas.

[2537]. 44.1 : 23.26 : 12.25. ROBBINS, P. W., GRIGSBY, B. H., and CHURCHILL, B. R. **Report on chemical weed control for conifer seedlings and transplants.** *Quart. Bull. Mich. agric. Exp. Sta.* 30 (2), 1947 (237–40).

In the spring of 1946 a series of weed-control plots were established in one-year-old seedbeds of Norway and White Spruce, Jack Pine, Douglas Fir and Balsam Fir, Ponderosa Pine and White Pine, and in transplant rows of Northern White Cedar, White Spruce and Red Pine. A 2-per-cent. solution of sulphuric acid, a 5-per-cent. solution of phosphoric acid, Dow Selective Weedkiller, 2,4-D, and Stanisol were used. The trials indicated Stanisol (a petroleum product of the naphtha series) to be the only chemical that would control the weeds and not harm the conifer seedlings. The spray was applied on warm bright days, using a back-pack sprayer and a fog nozzle. Details are given of the results of various tests. It is concluded that Stanisol will effectively reduce the weeding problem in Pine seedling beds, and will cause little damage if applied while the seed coats are still on the cotyledons or if applied after the trees are one year old. Stanisol is also effective for the control of weeds in transplant rows if the spray is applied while the weeds are small. Enough spray should be applied to wet the leaves of all weed plants. One gal. per 600 sq. ft. is suggested, but more may be required when weed growth is heavy. Some differences in the tolerance of various species of conifers have been found, and small-scale trials on species other than Ponderosa

Pine and White Pine (which have been thoroughly tested) are recommended before treating large areas of seedlings. Low spraying pressures, 50–75 lb., are adequate for weed control; pressures in excess of 100 lb. may injure the seedlings, and should not be used.

[2538]. 44.1 : 23.26 : 12.25. **New weed killer for Southern Pine.** *Amer. Nurserym.* 87 (1), 1948 (36–7).

Ordinary dry-cleaning fluid applied as a spray has been found effective as a weedkiller for Southern Pine nurseries, and its use is expected to save 22 southern state and federal forest-tree nurseries more than $100,000 in weeding costs next year and practically to eliminate hand weeding. The dry-cleaning fluid is applied with an ordinary power sprayer which carries an 18 ft. boom capable of treating 3 seedbeds at once; 25–30 gallons of spray are applied per acre, depending on the age of the trees. The spray can be applied as early as 7–10 days after germination, without injuring the seedlings. One spraying will last as long as 3 weeks, depending on weather and weed conditions. The fluid evaporates in time without harm to the soil. Killing is rapid. This weedkiller should not be used indiscriminately, however, as it will kill cotton, hardwood seedlings, and many broadleaved plants. But when used properly it will not harm Southern Pine and Cedar seedlings. A few minor weeds are resistant to the spray. Whereas weeding 1,000 trees by hand costs from 60 cents to $1.50, this selective herbicide does the job for 5 cents.

44.3. *Fungi*

See also *For. Abstr.* 9 (Nos. 2274, 2518).

[2539]. 44.3 (213) : 01.2. **A list of common tropical plant diseases.** *Mimeo. Publ. imp. mycol. Inst.* No. 4, 1947. pp. 62.

The form of this list differs from that of the *List of common British plant diseases*, in that the synonymy of the causal organism, together with the correct author citation and place of publication of the binomial for the pathogen are given. Diseases are arranged alphabetically under the host plant. The list as it stands is only a tentative draft, issued for the comments and criticism of overseas workers. It is proposed to submit it to the 4th Imperial Mycological Conference, 1948.

[2540]. 44.3 : 12.25 : 12.26–8 : 12.21 (51). WEI, C. T. **Two new fungi from Szechuan.** *Bot. Bull. Acad. Sinica* 1 (3), 1947 (209–12).

Uncinula bischofiae was found on leaves of *Bischofia trifoliata*. *Gymnosporangium tsingchenensis* was found on *Cupressus funebris* at a height of about 2,000 ft. on Tsing Chen Shan. Infection often leads to witches' broom on young branches and the exudation of gum. Death may result 2 or 3 years after infection in the case of small twigs, and whole large trees may be killed if the trunk is girdled.

[2541]. 44.3 : 12.25 : 12.21 (676). NATTRASS, R. M., and CICCARONE, A. ***Monochaetia* canker of *Cupressus* in Kenya.** *Emp. For. Rev.* 26 (2), 1947 (289–90 + plates).

A canker disease of *Cupressus macrocarpa* in Kenya, caused by *Monochaetia unicornis* (Cooke and Ellis) Sacc., is compared with a disease on the same host in California caused by *Coryneum cardinale* Wagener, and the similarity of the two diseases noted. The disease in Kenya appears to be confined to the highlands east of the Rift Valley. *Author's summary.*

[2542]. 44.3 : 12.25 : 12.21 (493). DELEVOY, G. A propos d'un cas de virulence exceptionelle de *Armillaria mellea* (Vahl) Quel. [**An exceptionally virulent infection [of Japanese Larch] by *Armillaria mellea*.**] *Bull. Soc. for. Belg.* 53 (4), 1946 (104–14). [F.]

[2543]. 44.3 : 12.25 (485) : 32.1 : 31.8 : 46. SILVÉN, F. Stämpelröta hos gran i Norrland. [**'Blaze rot' in Norway Spruce in Norrland.**] *Norrlands SkogsvFörb. Tidskr.* 1944 (2), (135–58). [Sw.]

A previously unpublished report on studies made in the vicinity of Lycksele in the early '30s. Results, for which no more than local validity is claimed, were as follows: (1) Season appeared to be very important: of blazes made in July, August, September and June, 1932 and in March, 1933, the percentages showing rot after felling in April, 1934 were respectively 54, 23, 20, 11 and 2, with average lengths affected of 54, 33, 37, 52 and 21 cm. (2) The point of the compass faced by the blaze appeared to have no influence. (3) Size and depth of blaze seemed to have no effect on the incidence and development of rot other than that of offering a large area on which infection might take place, though this factor is obviously

an important one. (4) Unthrifty trees were not attacked more frequently than thrifty ones. Once established, however, rot developed more rapidly in the longitudinal direction in the former than in the latter, but this difference was compensated by more rapid radial growth of rot in the more vigorous trees. (5) Though unsupported by figures, it is claimed that environment has a great influence on the occurrence of this type of rot. Pure Spruce stands are more liable to attack than mixed ones, and attack probably increases with altitude. (6) In old Spruce forest of the type in question, it is estimated that 'blaze rot' grows in length at an average rate of 30 cm. annually for the first few years after attack.

In timber, two years' rot development of this type would be insufficient to affect utilization, except to a small extent where the slabs are resawn for boxboards, etc. In pulpwood also, the defect would generally be of entirely minor importance compared with included bark or dead knots.

[2544]. 44.3 : 12.25 : 12.21 (798). ENGLERTH, G. H. **Decay of Sitka Spruce in south-eastern Alaska.** *J. For.* 45 (12), 1947 (894–900).

Decay of Sitka Spruce in S.E. Alaska was studied in 630 trees on 11 plots. Data on age and size of trees, kinds and amount of decay, were recorded. The more important fungi found on living Sitka Spruce were *Polyporus schweinitzii*, *P. borealis*, *P. sulphureus*, *Fomes pinicola*, *F. pini*, *F. officinalis* and *Lentinus kaufmannii*. Sporophores of these fungi, excepting *F. pini*, were produced infrequently or not at all on living trees. No swollen knots were observed in association with *F. pini* infections. In most cases, frost cracks, injuries caused by falling trees, or broken tops, provided the only indication of the presence of decay. [Cf. *For. Abstr.* 9 (No. 1274).]

[2545]. 44.3 : 12.25 : 12.21 : 13.2. GRUENHAGEN, R. H., RIKER, A. J., and RICHARDS, C. A. **Burn blight of Jack and Red Pine following spittle insect attack.** *Phytopathology* 37 (10), 1947 (757–72).

Jack Pine [*Pinus banksiana*] trees affected with burn blight have been dying since 1941 in north-eastern Wisconsin and in Michigan. Examination revealed that feeding punctures of *Aphrophora saratogensis* were common on the diseased trees and that necrotic spots caused by *Chilonectria cucurbitula* developed around some of the punctures, gradually enlarging and coalescing to girdle the twigs. The fungus moved down the cortex of susceptible trees and killed them in 1–3 years. The evidence suggests that the insects not only act as vectors of the disease, but also weaken the twigs and render them more susceptible to infection. *From authors' summary.*

[Cf. *For. Abstr.* 9 (No. 2582).]

[2546]. 44.3 : 12.25 : 12.21 (82). MARCHIONATTO, J. B. Ensayos de laboratorio con el *Fusarium vasinfectum.* [**Laboratory experiments with *Fusarium vasinfectum.***] [*Publ.*] *Inst. Sanid. veg. Argent.* (*Ser. A.*) 2 (22), 1946. pp. 7 + plates. [Span.e.]

The behaviour of 3 stocks of *Fusarium vasinfectum* isolated from Pine in 1933 and from cotton in 1937 and 1942, was tested on seedlings of *Pinus halepensis* and cotton. The 1933 stock had lost its pathogenicity, that of the 1937 stock was weak, whereas the 1942 stock was virulent towards both Pine and cotton. *From author's summary.*

[2547]. 44.3 : 12.25 : 12.21 (493). BOUDRU, M. La maladie des pousses du pin noir d'Autriche, *Brunchorstia destruens* Eriksson. [***Brunchorstia destruens*, die-back of *Pinus nigra* var. *austriaca*.**] *Bull. Soc. for. Belg.* 53 (1/2), 1946 (2–14 + plate). [F.]

Reviews and analyses the existing data on *Brunchorstia destruens*, which causes a die-back of Austrian Pine. Deals with mode of attack, symptoms, systematy and morphology of the fungus, extent of the disease in Belgium and elsewhere, damage, and methods of control. [Cf. *For. Abstr.* 9 (No. 2117).]

[2548]. 44.3 : 12.25 : 43.11. [**Effect of fire on canker reduction in Slash Pine plantations.**] *Rep. Sth. For. Exp. Sta. 1946*, [1947] (44).

Present evidence from several young plantations of *Pinus palustris* is that fires can appreciably reduce the number of branch cankers present at the time of burning, also the number of surviving cankers that sporulate. Cankered trees were usually more easily killed by fires than uncankered. On the other hand, there were indications that earlier shoot and needle growth in the spring following fires might indirectly lead to increased cankering under certain conditions, and the use of fire

for canker control cannot be recommended until further data are available.

[2549]. 44.3 : 12.25 : 12.21 (75 : 76). SIGGERS, P. V., and LINDGREN, R. M. **An old disease—a new problem.** *Sth. Lumberm.* 175 (2201), 1947 (172–5).

The prevalence and distribution of *Cronartium fusiforme* on Southern Pines are dealt with [cf. *For. Abstr.* 2 (246–7)]. Studies have been made of damage and losses in plantations and natural stands of Slash and Loblolly Pine and some figures taken from Slash Pine plantations are given. Weather conditions from March to mid-June have a marked effect on rust infection. A period of 18 hours of atmospheric humidity at or near saturation point and with temperatures between 60° and 80° F. favours abundant Pine infection. The effect of weather on the time of leaf and needle growth on Oaks and Pines in the spring in relation to periods of spore production is also of importance. Cropping, cultivation and manuring may increase susceptibility; infection of Slash Pines established in old fields has been found to be twice as frequent and much heavier than in similar plantations on uncultivated ground. Fire may also increase infection, particularly in the lowest surviving branches. This may be due to the tree's breaking winter dormancy. Early growth provides susceptible tissue when rust spores are abundant. Density of stocking also influences amount and type of infection. In dense stands the shading out of lateral branches can eliminate a seat of infection; in heavily infected areas plantations of 4 × 4 ft. or 4 × 5 ft. are preferable to the usual 6 × 6 ft. spacing. When thinning, stem-cankered trees and those having branch cankers within 15 in. of the trunk should be removed first. Pruning of branches at the branch stage of infection (the stem not yet being cankered) will also reduce loss: it is most effective before the trees are 10 ft. high. There are probably genetic differences in resistance and susceptibility but no resistant strain has yet been produced.

[2550]. 44.3 : 12.25 : 12.21 : 12.26–8 : 23.26. SIGGERS, P. V. **Temperature requirements for germination of spores of *Cronartium fusiforme*.** *Phytopathology* 37 (12), 1947 (855–64). [U.S. Bureau of Plant Industry, Soils and Agricultural Engineering, Saucier, Miss.]

The effect of temperature on germination of four types of spores produced in the spring by *Cronartium fusiforme* is studied. The minimum period required to start germination was as follows:—(1) fresh aeciospores, 2¼ hrs. at 23° C.; (2) one-day-old urediospores, less than an hour at 25°; (3) teliospores, 9 hrs. at 17–23°; (4) sporidia, 2¼ hrs. at 28–29°. Germinative capacity of a spore lot varied with age and storage conditions. Aeciospores retained a high germinative capacity for 76 days when stored at a temperature below 10° C. Urediospores stored under similar conditions were still germinable when 223 days old. Teliospores germinated after exposure to fluctuating temperatures in a greenhouse for 63 days. Attempts to store sporidia were not successful. The lower and upper limits for germination were:—(1) Aeciospores, slightly below 11° and 29° (optimum about 21°); (2) urediospores, slightly above 8° and 29°; (3) teliospores approximately 15° and 26°; (4) sporidia, between 13° and 14°, and a little above 29° (optimum 22°). This information should help in preparing effective spray schedules to coincide with periods of high infection in forest nurseries. For example, germination of sporidia, and therefore infection of Pine, does not occur at 13° and spraying can be deferred until the temperature rises above this level.

[2551]. 44.3 : 12.25 : 12.21 (485). LAGERBERG, T. *Coniophora fusispora*, en rötsvamp i norrländsk tall. [***C. fusispora*, a rot fungus of Scots Pine in Norrland.**] *Norrlands SkogsvFörb. Tidskr.* 1944 (2), (123–34). [Sw.e.]

C. fusispora, provisionally so identified by the author [see *Svenska SkogsvFören. Tidskr.* 33, 1935 (177–264)] as the cause of a butt rot of living trees of Scots Pine in Swedish Lapland, has been studied further in culture and the identification confirmed. The mycelium in culture was at first pure white but after about a month's growth started to turn deep yellow, beginning at the periphery, and later snuff-brown. During the period of rapid growth the young mycelium had a strong scent of *Acacia* (e.g. *A. decurrens*) flowers. After the addition of a block of Pine wood, fruiting bodies developed in a culture about 5 months old. The spores, which are figured with the basidia, measured 15–19·7 × 5·6–7·5 μ.

[2552]. 44.3 : 12.25 : 12.21 (485). NENZELL, G. Redogörelse för undersökningar åren 1940–43

över snöskyttesvampen och dess bekämpande i tallföryngringar å Bergvik och Ala Nya A.-B:s marker. [**Report on investigations in 1940–43 on *Phacidium infestans* and its control in Scots Pine regeneration on the lands of Bergvik and Ala Nya A.-B.**] *Norrlands SkogsvFörb. Tidskr.* 1943 (4) (293–314). [Sw.] BJÖRKMAN, E. Snöskyttefrågan. [**The snow-blight problem.**] *Norrlands Skogsv-Förb. Tidskr.* 1944 (1), (53–60); 1945 (1), (44–6). [Sw.] MATTSSON MÅRN, L., and NENZELL, G. Snöskyttefrågan: ett genmäle. [**The snow-blight problem: a reply.**] *Norrlands SkogsvFörb. Tidskr.* 1944 (4), (344–9). [Sw.] MATTSSON MÅRN, L. Några skogliga synpunkter på snöskytteproblemet. [**Some silvicultural points on the snow-blight problem.**] *Norrlands SkogsvFörb. Tidskr.* 1944 (4), (380–402). [Sw.]

Nenzell summarizes and discusses investigations reported previously [see *For. Abstr.* 4 (126); 5 (199, 278)], and describes some experiments on possible control measures:—(1) *Removal of infected trees and infected branches* in young Scots Pine stands shortly after the melting of the snow in spring, when it is easy to distinguish the affected parts. A first trial in 1940 was quite unsuccessful, but in a second in 1942 (*a*) where soil cover as well as infected plants or branches were removed, no fresh attack developed; (*b*) where only infected material was cut out, new attacks developed only on parts that had come into contact with ground vegetation; (*c*) where infected material was cut out and all plants were pruned to a height of about 30 cm., there was no fresh attack. (2) *Spraying with fungicides*: Of various fungicides tried, only 'Spinntex' (tar carbolineum in oil) was fully effective. Concentrations as low as 2 per cent. gave good control provided that 0·4–0·5 litre of spray was applied per plant group of 20–30 cm. radius and with *Phacidium* attack up to a height of about 30 cm. Sprays applied in June–August were less satisfactory than those applied later, the best results being given by spraying in late October or November. From a provisional estimate of costs it is concluded that spraying would pay in nurseries but probably not in young plantations where extensive applications have to be made.

Björkman's article consists mainly of criticism of individual points in Nenzell's paper, particularly of the latter's opinion that infection by airborne spores is much less important than that effected by the mycelium arising from unshed spores in apothecia on infected needles and spreading through the snow, particularly during the spring thaws, to fresh hosts. It has not been satisfactorily proved that the most vigorous growth of this mycelium occurs in late winter, though this is quite possible. It is agreed, however, that mycelial activity is suspended during the midwinter cold. Björkman has induced unshed spores to germinate as early as mid-October, in the absence of snow, and succeeded in obtaining autumn infections of healthy needles with pure cultures of *Phacidium* mycelium. He emphasizes that to secure complete control by spraying, it would be necessary to treat the plants every year until they reach a height of 50–80 cm. (i.e. until they are clear of normal snow level).

Mattsson Mårn, in common with Nenzell, believes that infection by mycelium growing in the snow is the most important. There is some evidence that infection is favoured by much snow and a long period of melting in the spring. He regards *Phacidium* attack as one of the major causes of permanent unregenerated gaps on the Norrland Pine heaths [cf. *For. Abstr.* 7 (No. 1719)]. Whereas in central and S. Sweden, 'sterile' patches, ascribed to root competition and other factors, occur commonly under seedbearers, in Norrland patches of regeneration often occur in this situation and often closely follow the shape of the crown projection on the ground, while the open gaps fail to regenerate. Of the several factors which might and probably do contribute to this effect, *Phacidium* attack in the gaps, and its comparative absence under seedbearers, are believed to be very important. Snow lies shallower and melts faster in the latter situation, as it does round small trees, lying logs, etc., where small patches of regeneration are also observed.

The chief aim must be to get regeneration above the snow level as quickly as possible. No immune plants have been discovered in either natural regeneration or plantations of native and exotic strains of Scots Pine, but strains of rapid growth in youth should have better chances of survival. Should any marked periodicity be discovered in *Phacidium* attacks, regeneration fellings ought to be timed appropriately. On sites with thick humus, burning should help both to reduce sources of inoculum

for a while and to give the seedlings a good start. The alternatives would seem to be felling and burning of fairly large areas at intervals of some years, in order to gain a period of respite, or else regeneration under light shelterwood.

For controlling *Phacidium* in valuable young stands it might be worth while to make further trials with the clearance of infected material, fungicidal dusts or sprays—possibly applied to the snow, or applications of charcoal breeze or the like to the surface of the snow in spring, in order to hasten melting. [Cf. also *For. Abstr.* 9 (No. 1886).]

[2553]. 44.3 : 12.26–8 : 12.21 (45). PAVARI, A. La lotta contro un nuovo flagello dei nostri castagneti (*Endothia parasitica*). [**The struggle with a new scourge of our Chestnut groves (*Endothia parasitica*).**] Mariano Ricci, Florence. 1947. pp. 19. [It.] *Repr.* from *Atti della Accademia dei Georgofili.*

The author first gives an account of the disease and its spread in the U.S.A. as observed personally in that country, and also adverts briefly to a visit to the plantations of Asiatic Chestnuts in the North of Spain. He then describes the measures which are being taken against the disease in Italy.

(1) *Curative measures.* Trials are being made of various fungicidal substances, especially salts of copper and of iron. In one experiment, small infected branches are pruned and burnt and the wounds treated with ferric sulphate. Other experiments are being made with sprays, both with and without stickers, and soaking the trunk with fungicidal solutions. Trials are also being made of various chemical fertilizers that may have a remedial effect, particularly by affecting the degree and variation of the sap concentration, which appears to be a vital factor in the plant's resistance to the disease.

(2) *Search for resistant clones of Castanea sativa.* At the Masone nursery in the province of Genoa, seed has been sown of more than 120 varieties or provenances from every part of Italy. The resulting plants will be artificially inoculated in order to test their resistance. It is hoped to make similar trials in central and southern Italy. During the previously mentioned visit of the author and his colleagues to the plantations of Asiatic Chestnuts in the neighbourhood of Bilbao and Santander, they discovered with surprise the presence of *Endothia parasitica*, or at least a fungus very closely resembling it, on almost every plant of *Castanea crenata*, while it was never met with on indigenous Chestnuts [*C. sativa*] in the immediate vicinity, except in one instance where a tree attacked at the butt had reacted vigorously with callus formation and showed perfectly normal growth and foliage. The cankers observed on the Japanese Chestnuts originated at least 15–20 years ago and the infection was still active on young branches. The localization of the disease on the ordinarily more resistant Japanese species is the more remarkable, having regard to the climate of Cantabria, with its mild winters and humid summers which are particularly favourable to fungal growth. It is intended to experiment with seed and vegetative material from these apparently resistant Spanish Chestnuts.

(3) *Introduction of oriental species of Castanea.* Experimental plantings of *C. crenata* were made more than 20 years ago, but the resistance of this species to *Endothia* is very variable. *C. mollissima* is regarded as a more hopeful subject, particularly as it produces good fruit and is said to flourish on calcareous soils. Experimental sowings and grafts are to be made with material from Spain. Another hopeful variety is the Korean Chestnut, whose systematic position is doubtful but appears to be nearer to *C. mollissima* than to *C. crenata*. Plantations of this Chestnut in Spain, like those of *C. mollissima*, were perfectly healthy though adjacent to cankered stands of *C. crenata*. It is a fast growing tree (a specimen in Bilbao province was 10–13 m. high and 22 cm. d.b.h. at 17 years old) and deserves to be studied from the biological as well as the systematic point of view.

(4) *Hybridization.* Hybrids of *C. crenata* and *C. sativa* have already been produced at the Masone nursery and, as soon as pollen has been obtained from U.S.A. and Spain, further hybridization will be carried out with *C. mollissima.* [Cf. *For. Abstr.* 9 (No. 2473).]

[2554]. 44.3 : 12.26–8 : 12.21 (83). ARENTSEN, S. Acerca de *Mikronegeria fagi* Diet. et Neg., roya del roble y del raulí. [**Notes on *Mikronegeria fagi* Diet. and Neg., a rust of *Nothofagus obliqua* and *N. procera*.**] *Agricultura tec., Santiago* 7 (1), 1947 (49–54). [Span.] A.P.B.

[2555]. 44.3 : 12.26–8 : 12.21 : 12.11.3. HEPTING, G. H., and TOOLE, E. R. **Wilt epidemiology and resistance in the Mimosa tree.** *Abstr.* in *Phytopathology* 38 (1), 1948 (13).

During the last 12 years the *Fusarium* wilt of *Albizzia julibrissin* has spread widely and is now found in 76 counties from Maryland to Alabama. Search for wilt-resistant strains was begun in 1939; 632 seedlings were grown from seed collected from Maryland to Louisiana. After several inoculations, the remaining healthy seedlings were planted in infected soil. Twenty of them remained wilt-free for 5 years, and cuttings taken from these resistant seedlings have also proved resistant to infection.

[2556]. 44.3 : 12.26–8 : 12.21 (73). WALTER, J. M. **Canker stain of Planetrees.** *Yearb. Agric. U.S. Dep. Agric. 1943–7*, 1947 (481–4). O.R.E.

Account of the *Endoconidiophora* disease of *Platanus acerifolia* in the United States, and measures of control. [Cf. *For. Abstr.* 8 (Nos. 1430, 2107).]

[2557]. 44.3 : 12.26–8 : 12.21 (85). CRANDALL, B. S. **Cinchona root disease caused by *Phytophthora cinnamomi*.** *Phytopathology* 37 (12), 1947 (928–9).

A root disease, discovered during the wet season of 1945–46 in *Cinchona officinalis* plants at the Estación Experimental Agrícola de Tingo María, Peru, was caused by *Phytophthora cinnamomi*. Root rot of Cinchona from the same cause has been reported from British Malaya, but this is its first occurrence in the Western hemisphere. The disease may be reproduced on healthy seedlings by inoculation only under conditions of high soil moisture. Isolates of *P. cinnamomi* from Cinchona are indistinguishable from isolates from root rot of Avocado from the same region, but the determination of strain differences has not yet been undertaken. This disease is not to be confused with that caused by *P. quininea*. [Cf. *For. Abstr.* 9 (No. 1282).]

[2558]. 44.3 : 12.26–8 : 12.21 (492) : 21.3 : 21.8 : 13.15 : 13.2. PELKWIJK, A. J. TER, and BRINK, G. Verslag van het onderzoek 1943–1945 en 1946 naar den populierenkanker. **[Report on investigations in 1943–45 and 1946 on bacterial canker of Poplars.]** *Meded. ned. Heidemaatsch.* No. 2 [1947?]. pp. 21. [Du.e.] [Phytopathologisch Laboratorium W. Commelin Scholten, Baarn.]

(1) *The organism responsible*: Typical bacterial canker has never yet been produced by inoculating Poplars with any organism or combination of organisms derived from pure cultures. *Pseudomonas rimaefaciens*, the presumed cause of the disease, produces cankers but not typical ones. The causal organism must be limited in conditions for reproduction, as infection with crude bacterial exudate is possible only for a short period in the year. The period of susceptibility appears to be influenced by weather.

(2) *Inoculation technique*: A new method was tried in which small pieces of diseased tissue were inserted into T-shaped cuts, which were then sealed with cellophane. Results were less regular than with bacterial suspensions, and larger branches are necessary for inoculation, but whereas inoculations with suspensions were unsuccessful after June, positive results were obtained with the new method up to September. The most successful inoculations were those made with living tissue from the margin of cankers.

(3) *Resistance tests*: (*a*) *Susceptibility rating*: A 4-point scale, based on degree of cankering and exudation, was used. For species such as *P. canescens* and *P. alba*, in which rough cankers are seldom developed and symptoms are usually restricted to bark fissuring and slime exudation, a subsidiary rating, based on these symptoms (which closely resemble those following inoculation with pure cultures of *P. rimaefaciens*), was introduced. Species reacting in this manner were *P. berolinensis*, *P. trichocarpa* (Bakkum provenance), *P. suaveolens*, *P. tremula* and *P. tristis*. Late infections of species normally forming cankers may also give similar reactions. (*b*) *Weather*: After mild winters the first exudation of slime was earlier and much more pronounced than after severe ones, and the period of susceptibility occurred earlier. Under such conditions spontaneous natural infections occurred commonly in the more susceptible species and also in species which seldom canker in nature, e.g. *P. serotina*, *P. marilandica*, *P. deltoides* var. *missouriensis* and *P. robusta*. No such infections occurred in *P. nigra*, and only one instance each in *P. gelrica* and *P. berolinensis*. (*c*) *Relative susceptibility of species*: Types appearing resistant or moderately so were P

nigra (except that from Bennekom), *P. berolinensis*, *P. trichocarpa* (only that from Bakkum), *P. gelrica*, *P. serotina* var. *erecta*, *P. regenerata* and its var. *erecta*, *P.* 'caroliniano prodigioso', *P.* 'ibrido italiano A.M.', *P.* 'ibrido italiano B.L.', *P.* 'monolifero', *P. tristis* and *P. rasumowskyana* (the material of these last two appears to be identical). Moderate susceptibility was shown by *P. canescens*, *P. alba*, *P. fremontii*, *P. suaveolens*, *P. eugenei* (Metz), *P. marilandica*, *P. serotina*, *P. deltoides* var. *missouriensis*, *P. robusta* and the Stout and Schreiner hybrids Nos. 3, 6, 8 and 10. Susceptible to very susceptible types were Stout and Schreiner No. 5, von Wettstein No. 3, *P. candicans* and *P. angulata erecta*. Weekly inoculations were made in 1943 to discover whether the period of susceptibility varied in the different species. Contrary to expectations, it was on the whole uniform for all the species tried, though the time of peak susceptibility varied in different years and different localities. (*d*) *Hybrid seedlings*: Various seedlings from artificial crosses of *P. nigra* and *P. marilandica* with other species, raised in 1942, and of *P. tremula* raised in 1943, were inoculated in 1944. After a check in September 1945, when the 1942 seedlings were generally healthy and those of 1943 (with the exception of *P. tremula* × *serotina erecta*) largely diseased, all plants rated as moderately susceptible or worse were removed. In 1946 the remainder were re-inoculated, and from the provisional results *P. nigra* × *nigra* appears the most resistant, followed by *P. marilandica* × *nigra italica*. *P. tremula* crosses did not give bad results, but it is feared that disease may be latent.

(4) *Soil acidity and nutrient status*: Inoculations in 1944 of 2-year-old *P. brabantica* and *P. trichocarpa*, grown under controlled soil conditions in cement pits, were followed in all cases by cankering, rather more severe at first in the series on acid (pH 5) soil and more severe in the former than in the latter species, though these differences had evened out by the succeeding summer. Evidence was obtained to show that: (*a*) A pH of 5 is too low for healthy growth of either species. (*b*) At pH 7·5, P deficiency had little effect on growth, though it caused early leaf-fall. (*c*) N deficiency seriously hampered growth and caused chlorosis. (*d*) In the alkaline series, K deficiency retarded growth of *P. brabantica* but not that of *P. trichocarpa*. (*e*) Excess K hastened leaf-fall but did not hamper the growth of *P. brabantica*; in *P. trichocarpa*, however, it evoked symptoms of poisoning, and die-back of young shoots occurred as early as summer 1944. (*f*) Excess P was also harmful to *P. trichocarpa*, with symptoms as for excess K. (*g*) Excessive soil acidity had less effect on growth if excess N was present.

In 1945 this trial was replaced by a similar one, using the less susceptible species *P. serotina* and *P. robusta*. An acid soil continues unfavourable. The former species is apparently the more sensitive to differences in soil nutrients. Excess of P, and excess or deficiency of K, have caused top die-back and the development of numerous lateral shoots.

(5) *Possible vectors*: Studies of *Cryptorrhynchus lapathi* in Holland have shown that its life cycle may be annual or (probably for the most part) biennial. Bark injuries are caused by the adults in Aug.–Sept. and in May–June, the latter period roughly coinciding with that of greatest susceptibility of the trees to infection. Inoculation tests using infected beetles gave only one positive result. A further suspected vector is *Grapholitha corallana*.

(6) *Dothichiza populea*: Growers are warned against leaving branch stubs about 15 cm. long when pruning planting stock. These are an ideal entrance for fungi, especially *D. populea*, which attacks many species, e.g. *P. robusta*, *P. angulata erecta*, *P. simonii fastigiata*, *P. berolinensis*, *P. gelrica*, *P. marilandica*. The varieties most seriously attacked at Baarn in 1946 were *P. nigra* var. *italica*, *P. deltoides* var. *missouriensis*, *P.* 'ibrido italiano A.M.' and a stock of *P. serotina* from Schiemer, Natal. [Cf. *For. Abstr.* 8 (No. 2727); 9 (No. 2133).]

[2559]. 44.3 : 12.26–8 : 45.3 : 34.28. TUINZING, W. D. J. Ziekten en plagen van den wilg in grienden. [**Diseases and pests of Willows in osieries.**] *Landbouwk. Tijdschr.*, 58 (703), 1946 (639–44). [Du.] C.G.B.

In Holland, the cankers most commonly found on Willow species in osieries are caused by *Physalospora miyabeana*, *Discella carbonacea*, *Myxosporium salicinum* and *Fusicladium saliciperdum*; the chief insect pests of Willow species are *Cryptorrhynchus lapathi*, *Rhynchites tomentosus*, *Phyllodecta vitellinae* and *Ph. vulgatissima*, *Galerucella lineola*, *Tortrix* spp., *Cecidomyia* spp. and *Dasyneura* spp.

[2560]. 44.3 : 12.26–8 : 12.21 (492) : 12.11.3 : 05.3. WENT, J. C. Verslag van de onderzoekingen verricht in 1946 voor het Comité inzake bestudeering en bestrijding van de iepenziekte en andere boomziekten, uitgevoerd op het phytopathologisch laboratorium 'Willie Commelin Scholten' te Baarn. [**Report on research carried out in 1946 on behalf of the Committee for the Study and Control of Elm Disease and other Tree Diseases, at the 'Willie Commelin Scholten' Phytopathological Laboratory, Baarn.**] [*Mededeeling* No. 42.] 1947. pp. 12. [Du.e.]

Describes and tabulates the results of inoculation with *Ceratostomella ulmi* of Elm seedlings and grafts selected for their resistance to the disease. Hybrids from 7 different crosses showed no disease during the years of investigation (varying from 5 to 9) but their number was too small for any definite conclusions to be drawn. The parent plants were *U. hollandica belgica*, *U. hollandica vegeta*, *U. horsholmensis*, *U. foliacea* No. 1, *U. foliacea* No. 28, *U. pumila pinnatoramosa* and *U. wallichiana*. The hybrids *U. hollandica vegeta* × *U. foliacea* No. 1 and *U. foliacea* No. 1 × *U. foliacea* 28 constituted half of the total number tested during 1946 that remained healthy after inoculation. Of the grafts of *U. foliacea* No. 62, 14 per cent. were diseased or slightly diseased after inoculation, a higher percentage than in 1945; this variety proved very resistant to *Nectria cinnabarina*. Investigations were also made into a disease of *Picea abies*, a *Rhizosphaera* and a *Phoma* being isolated from diseased needles, and into fungus diseases of *Alnus glutinosa*. During 1946 the disease of Douglas Fir caused by *Phaeocryptopus* (*Adelopus*) *gaeumanni* was observed in Holland for the first time. *From author's summary.* [Cf. *For. Abstr.* 8 (No. 2110).]

[2561]. 44.3 : 12.26–8 : 12.21 : 41. DIMOND, A. E. **Chemotherapeutic action of 8-quinolinol benzoate against Dutch Elm disease.** *Abstr.* in *Phytopathology* 38 (1), 1948 (7–8).

Beneficial results are most pronounced when 0·1-per-cent. solutions are injected under pressure into the soil round the feeding roots at the rate of 5 gal. per in. d.b.h. Surface watering over feeding roots is less effective, and scattering of dry chemical followed by watering is ineffective. Treatment before leaf buds expand is without effect. Trees treated in very early stages of infection benefit most; when infection is extensive, treatment has little effect. Remedial action begins to wane after 90 days and ceases after one year. Complete recovery of diseased trees is infrequent, but treated ones recover more often than untreated ones do. [Cf. *For. Abstr.* 9 (Nos. 2070–71).]

[2562]. 44.3 : 12.26–8 : 12.21. FENNER, L. M., and FATE, L. R. ***Ceratostomella ulmi* on Elm bark treated with 2,4-dichlorophenoxyacetic acid.** *Phytopathology* 37 (12), 1947 (925–8). [U.S. Bureau of Entomology and Plant Quarantine, East Orange, N.J.]

Abnormally large coremia of *Ceratostomella ulmi* were developed on Elm bark treated with 2,4-dichlorophenoxyacetic acid or the ammonium salt of this acid in concentrations varying from 1 to 6 g. per 800 cc. of sterilized water.

[2563]. 44.3 : 12.26–8 : 12.21 : 45.3 : 13.2. ROBERT, FR. A. **The biology of *Magdalis* and a new aspect of its rôle in the transmission of Dutch Elm disease.** *Bi-m. Progr. Rep. For. Insect Invest. Dep. Agric. Can.* 3 (5), 1947 (1–2).

Observations made last summer suggest that *Magdalis armicollis* generally oviposits on vigorous or only slightly weakened branches. The larvae cut off the circulation of the sap by their radiating tunnels, especially at forks, and produce complete desiccation of hitherto vigorous branches. The infestation by *Magdalis* may therefore be considered primary. Studies were made to determine whether *M. armicollis* can act as a vector of *Ceratostomella ulmi*. It is believed that a certain number of these weevils, at the time of emergence, carry the spores of *C. ulmi*, and that the contact they make with the inner bark of healthy Elms is sufficient to transmit the disease. Elm branches when examined in June, 1947, before any sign of wilting appeared, contained last-stage larvae and pupae of *M. barbita* and also the streaks in the wood which are associated with disease; these streaks later gave positive cultures of *C. ulmi*.

[2564]. 44.3 : 12.26–8 : 12.21 : 45.3 : 13.2 : 33.36.1. CONNOLA, D. P., COLLINS, D. L., and HAGMANN, L. E. **Log treatments for bark**

beetle control in connection with the Dutch Elm disease. *Bull. Cornell agric. Exp. Sta.* No. 841, 1947. pp. 43.

Reports on a series of experiments carried out at the Dutch Elm Research Laboratory of the N.Y. State College of Agriculture, as a result of which the following recommendations are made. Uninfested cut wood or broken limbs should be left on the ground in continuous dense shade, hidden in heavy ground cover. Infested wood should be left in the sun, with the pieces separated and not touching the ground, on a dry site not overgrown with grass, weeds, or brush. If the wood is exposed in this way, and turned over from time to time so as to receive hot sunlight, emergence is often prevented; in the winter, moreover, well exposed wood is specially subject to attack by woodpeckers, which may destroy all or most of the larvae on a given site. In no case should Elm wood be left in, under, or near valuable Elm trees. Uninfested wood in any situation, if covered with a good layer of hay (4 in. in the tests) with no surfaces exposed or protruding, may be expected to remain uninfested. Covering with hay does not prevent emergence from infested wood. Treatment of wood with fire (i.e. a blowlamp), steam or hot water may sometimes be feasible, and should result in high or complete mortality. Wood covered with a spray consisting of a light petroleum base, with the addition of creosote and a fumigant such as paradichlorobenzene, may be protected from beetle attack. For repellency, it is not necessary that all parts of each piece of wood should be completely covered, so that entire small piles of wood can sometimes be successfully treated. But to kill larvae in infested wood, complete coverage of all parts of each piece of wood is essential, the spray must be applied during a period of high temperature in the summer, and the wood must be left in the sun. When the beetles are in the pre-pupal or pupal stages, the results are likely to be erratic. Results of tests with chemicals on logs with thick bark are not encouraging.

In view of the limited period during which chemical treatment can be successful, it is concluded that natural and mechanical means of inhibiting beetle entrance and reducing beetle emergence, coupled with removal and burning where ever possible, are the best practical means of disposing of any Elm wood that is considered a hazard in Dutch Elm disease control.

45. DAMAGE BY ANIMALS

[2565]. 45 : 12.19 : 13.15. GALOUX, A. Les rapports entre les végétaux et leurs ennemis du monde animal. [**The relations between plants and their enemies of the animal kingdom.**] *Commun. Sta. Rech. Groenendael* (*Sér. C.*) No. 8, 1947. pp. 12. [F.f.flem.]

45.1. *Mammals*

See also *For. Abstr.* 9 (Nos. 2152, 2200).

[2566]. 45.1. BRIGHTEN, C. W. **Cattle grids for public highways and private drives.** *J. Land Agents' Soc.* 46 (11), 1947 (278–9 + plates).

An illustrated account of the method of constructing cattle grids in roads or drives, designed to prevent horses, cattle, sheep, pigs, deer, rabbits and hares from passing through a gap.

[2567]. 45.11 (497.2) : 34.21. STEFANOV, D. Pašata na dobitůka kato dvustranen faktor v gorskoto stopanstvo. [**Pasturage of domestic animals as a two-sided factor in forestry.**] *Gorsko Stopanstvo* 1 (4/5), 1945 (111–20). [Bulg.bulg.]

A plea for rational control of grazing in Bulgarian forests. Proper relief cannot be secured for the burdened mountain forests until agriculture is modernized and mechanization reduces the head of stock, but certain restrictions are essential, viz. protection of hardwood areas under regeneration fellings, with no sheep permitted in coppice less than 1 m. high, and no other stock in coppice under 2½ m. high. Such stringent precautions are not necessary for conifer regeneration, and sheep, rationally pastured, can help to control grass competition. Permissible incidences on a 150-day grazing season average 15 dk. (3·7 acres) and 1·5 dk. per head for large domestic stock and sheep respectively in lower-level forest; and 8 dk. (1·98 acres) and 0·8 dk. respectively for mountain forest. Large-scale goat breeding must, above all, be stopped and goats segregated in their own pastures.

[2568]. 45.11 : 12.25 : 13.2 (762). **Sheep damage to Longleaf Pine seedlings.** *Sth. Lumberm.* 175 (2201), 1947 (125).

Sheep allowed to graze in test plots of Longleaf Pine seedlings in south Mississippi damaged 86 per cent. of them, chiefly by browsing terminal buds. Seedlings with white woolly buds at least 0·4 in. long were most susceptible. As compared with ungrazed controls total height growth in 2 years was reduced by 25 per cent. and while only 4·6 per cent. of seedlings died, as compared with 2·3 per cent. in the control plots, more than 15 per cent. of those injured appeared to be permanently deformed. Main damage occurred in winter and early spring, but summer damage was enough to show that protection is needed throughout the year.

[2569]. 45.11 : 12.25 : 13.2 (75 : 76). HOPKINS, W. **Hogs or logs?** *Sth. Lumberm.* 175 (2201), 1947 (151–3).

Observations and some statistics on damage to Southern woodlands by domestic pigs, which uproot Pine seedlings and chew the bark off the tap-root. Longleaf Pine is the most susceptible species, especially when in the grass stage, and, as few forests in the Longleaf belt are fenced, natural second-growth stands rarely develop. Some figures relating to damage done in the Dry Prong Tract of the Palustris Experimental Forest, Louisiana, are given. Thirty-five per cent. of grass-stage trees were destroyed, but only 9 per cent. of trees 2 ft. high and none of 3 ft. high or over, although 12 per cent. of these last were heavily damaged. Slash and Loblolly Pine are also attacked, but less disastrously, as they grow faster and their roots are many and small compared with Longleaf. In Slash Pine plantations the pigs prefer the lateral roots of trees over 2 years old. Loblolly is less often attacked, since it has an even thinner root bark than Slash.

[2570]. 45.12 : 45.2. KALMBACH, E. R. **Advances in rodent control.** *Yearb. Agric. U.S. Dep. Agric. 1943–47.* 1947 (890–6). O.R.E.

Compound 1080, or sodium fluoroacetate, has proved toxic to all forms of life on which it has been tested and is an effective poison for the control of all types of rats, mice, squirrels and prairie-dogs. Highly soluble in cold water, it was first employed in the control of field rodents in Oct. 1944, proving signally successful against California ground squirrels. Its performance in the control of these and other field rodents has rarely been equalled, and, if baits prepared with it are protected by colour, it appears to be a reasonably safe poison from the point of view of bird mortality. The great objection to its use is its high toxicity to mammals, including domestic cats and dogs.

A rabbit-repellent paint known as '96a', combines copper carbonate, copper sulphate and dry lime sulphur as the active agents, with a synthetic resin and asphalt emulsion dissolved in ethylene dichloride as the adhesive. When applied to the bark of dormant trees, '96a' is effective in preventing damage by rabbits.

To make poisoned grain baits less dangerous to seed-eating birds, use is now being made of the fact that birds perceive and react to colour whereas rodents are almost completely colour-blind. Colours most effectively deterrent appear to be those near the centre of the humanly visible spectrum, the yellow and green bands.

45.3. *Insects*

See also *For. Abstr.* 9 (Nos. 2129–32, 2136, 2497, 2519, 2558–9, 2563–4, 2650).

[2571]. 45.3 : 07.7 : 41. POPHAM, W. L. **Blowers for insecticides.** *Yearb. Agric. U.S. Dep. Agric. 1943–47,* 1947 (839–42). [U.S. Bureau of Entomology and Plant Quarantine.] O.R.E.

Describes a unit developed for the purpose of distributing arsenicals or cryolite as concentrated sprays to which adhesives could be added. This tractor-mounted equipment is a combination of duster and sprayer. The basic principle is high-velocity air delivered through a 3½-in. flexible hose, which atomizes and projects in an even pattern either dusts or liquids or both. When the fan is driven at 4,000 r.p.m., the air is forced through the hose at about 160 m.p.h. By starting a break-up of the liquid with 30–50 lb. pressure on the nozzle that injects the liquid into the air stream, atomization is completed by the fast-moving air and the size of particles is reduced to 150–300 microns in diameter. It is possible to treat an acre of field crops, pasture, or even forest with as little as 1–3 gal. of liquid. At normal working speeds for a tractor, this unit

gave an effective distribution of insecticide over a swath 30–50 ft. wide; one man with a tractor treated 8–10 acres an hour, using 1–3 gals. of concentrated spray to the acre.

The Bureau of Entomology and Plant Quarantine has also designed a non-tractor blower of axial-flow type which projects atomized liquid for at least 100 ft. from the nozzle and is effective for treating street trees, ornamental plantings, small woods, etc. When spraying along roadsides, coverage adequate for control of many of the forest insects that cause defoliation in New England was obtained for a distance of 200–300 ft. from the nozzle. It can be used for dusting as well as spraying and is driven by a 22–25 h.p. petrol motor. The total weight of the unit with the insecticide tank full, is somewhat less than 1,000 lb.

Experiments so far have been made with DDT, nicotine, benzene hexachloride, and cryolite.

[2572]. 45.3 : 07.7 : 41. LATTA, R., and GOODHUE, L. D. **Aerosols for insects.** *Yearb. Agric. U.S. Dep. Agric. 1943–47*, 1947 (623–7). O.R.E.

Account of the generation and application of insecticides in aerosol form. The concentration of aerosols diminishes with distance from the generator and in order to obtain a high degree of control at a given distance, it is necessay to overdose the intervening area. It is therefore more economical to treat in narrow strips than in wide ones. Mosquito adults and larvae were controlled downwind from the point of generation for distances ranging from 1,200 ft. in heavily wooded areas to nearly a mile in open country. Gipsy-moth larvae in naturally infested forests were apparently completely wiped out for distances up to 900 ft., and enough residue remained to repel migrating larvae and prevent reinfestation.

[2573]. 45.3 : 07.7 : 41 : 12.25 : 13.2. **Airplane spraying with DDT for Spruce budworm control.** *Bi-m. Progr. Rep. For. Insect. Dep. Agric. Can.* 3 (5), 1947 (3–4).

The Bureau of Entomology and Plant Quarantine, in co-operation with the New York State Conservation Department, conducted tests during 1947 on aerial spraying with DDT to control the Spruce budworm. About 1,800 acres of infested Spruce/Fir forest in the neighbourhood of Cranberry Lake, N.Y., were sprayed with various dosages of DDT. The infestation, though light in some areas, and not comparable with the Canadian outbreaks, is thought to have been adequate to test the efficacy of the spray. Both oil and water solutions were used; application was made by two trainer-type biplanes, an N3N and a Stearman, each equipped with a 60-gal. spray tank, a boom suspended beneath the lower wing, and a wind-driven centrifugal pump mounted on the landing gear. A relief valve was adjusted so that a constant pressure of 25 lb. per sq. in. was maintained on the liquid during spraying. Operations were suspended when wind velocities exceeded 5 m.p.h. Details are given of the methods of sampling. The population reductions obtained for the various treatments indicate that the effectiveness of the sprays increased as the amount of DDT and the gallonage of solution per acre were increased. More even distribution of the spray was obtained by flying over an area 2 or more times. The application of 1 lb. of DDT in ½ gal. per acre caused little or no larval mortality, but 2 lb. in 3 gal. per acre resulted in almost complete control. Some 'burning' was noted on hardwood and herbaceous foliage where 1–2 gal. of spray per acre was applied, and severe burning on the plot treated with 3 gal. per acre; but none, so far, on coniferous foliage.

[2574]. 45.3 : 41 : 91.1. ADAMS, L. **The effects on mammals of DDT used in forest insect control in the Northern Rocky Mountains.** *Res. Note Nth. Rocky Mt. For. Range Exp. Sta.* No. 56, 1947. pp. 3.

During May, 1947, 290,000 acres of forest in Idaho were sprayed with DDT in an oil solution to control an epidemic of *Haemerocampa pseudotsugata*, and in July and August, 500 acres were sprayed in Wyoming in an attempt to control *Dendroctonus monticolae*. The opportunity was taken to study the effect of DDT on the indigenous wildlife. The evidence obtained indicates that, in general, DDT in amounts up to 7½ lb. per acre has little or no adverse effect on mammals, with the possible exception of shrews, which may be susceptible to the poison in the heavier doses. More detailed reports can be obtained by writing to the author at the Northern Rocky Mountains Forest and Range Experiment Station, Missoula, Montana.

[2575]. 45.3 : 41. SIEGLER, E. H., and HALL, S. A. **Hexaethyl tetraphosphate as an insecticide.** *J. econ. Ent.* 40 (5), 1947 (722–4).

Small-scale laboratory experiments have shown hexaethyl tetraphosphate (a German insecticide developed during the war and named 'Bladan') to be highly toxic to newly hatched codling-moth larvae, to several species of aphid and to the two-spotted mite. Further tests are needed to determine its practical value.

[2576]. 45.3 (71) : 05.3. CANADA. **Annual report of the forest insect survey; forest insect investigations: 1946.** Department of Agriculture, Canada. 1947. pp. 86.

[2577]. 45.3 : 12.25 : 13.2. GALOUX, A. Biologie et importance forestière de *Pityogenes chalcographus* Linné (Coleoptera Ipidae). [**Biology and silvicultural importance of *Pityogenes chalcographus*.**] *Trav. Sta. Rech. Groenendael* (*Sér. C*) No. 12, 1947. pp. 20. [F.f.e.g.flem.]

[2578]. 45.3 : 12.25 : 13.2 (741). BROWER, A. E. **The Balsam woolly aphid in Maine.** *J. econ. Ent.* 40 (5), 1947 (689–94).

Sixteen years' observation and research on the Balsam woolly aphid (*Adelges piceae*) in Maine are summarized. Infestations are most severe in low-lying, poorly drained or water-logged soils and centres of infestation are to be found in sites unfavourable to the growth of Fir. Such localities are indicated by certain associated mosses, grasses and other plants. Injury of two distinct types is produced. In the 'terminal phase' the distal portion of the branches is affected. Death of the part is caused by a severe attack; otherwise gall-like swellings and a typical 'gouty' look develop, while death of the terminal buds and loss of needles produce a characteristic stag-headed appearance in the tree. Infestation of the trunk also occurs and is usual heaviest below a height of 12–15 ft. This may be due to protection afforded by snow, for heavy infestations have also been seen higher up. Severe injury to the wood may be caused by the formation of many thick-walled vessels and an abnormal deposition of lignin. A reddish discoloration is also noticeable. [Cf. *For. Abstr.* 7 (No. 967).] Severe attacks are followed by reduced diameter growth. An account of the life history of the aphid is given. Annual records have shown that where the attack was 'medium' (i.e. several waxy masses present per sq. in.) only 30·3 per cent. of trees survived; when a 'heavy' stage was reached only 16·7 per cent. survived. Survivors of a 'heavy' attack were resistant to further attack, developing a thickened, rough, often somewhat checked and pitchy bark. Low temperatures afford the best natural control, —15 to —30° F. being lethal. Predators and parasites are of small importance in Maine [cf. *For. Abstr.* 4 (59)]. Lime sulphur at dormant strengths (1 to 8 and 1 to 12) has proved a successful controller and 5 gal. in 96 gal. water applied with force should give a 100-per-cent. kill. Stronger concentrations of oil are effective but may burn the tree. One part of oil to 25 parts water should be safe. Nicotine sulphate (1 to 4 parts) is a safe and effective spray. Sprays are most successful when directed against the crawler stage.

[2579]. 45.3 : 12.25 : 13.2 : 23.26. **Forestry pests.** *Rep. Dep. Agric. Qd. 1945–6*, 1946 (25).

Grubs of *Rhopaea magnicornis* cause much damage to Hoop Pine [*Araucaria cunninghamii*] seedlings in Queensland nurseries. Seedbed experiments were made to determine the effect of lead arsenate on infestations. Rates of application ranged from 10 lb./1,000 sq. ft. to 50 lb./1,000 sq. ft., the insecticide being mixed with sawdust and dug into the soil. After 2 years, the available data indicate that even the lowest rate of application gives almost complete immunity from white-grub attack during the period that the seedlings are in the beds. With the higher concentrations of lead arsenate, weed growth also was checked.

[2580]. 45.3 : 12.25 : 13.2 (492). FRANSEN, J. J. Bestrijding van de lariksmot (*Coleophora laricella*). [**Control of *Coleophora laricella*.**] *Ned. Boschb.-Tijdschr.* 20 (2), 1948 (41–56). [Du.e.] [Comité ter Bestudering en Bestrijding van Insectenplagen in Bossen.]

The chief features of the life history of *C. laricella* affecting its control are: (*a*) The adults emerge and die within a rather short period (the month of June). (*b*) The larva, on hatching, bores straight into the needle through the flat surface by which the ovum is attached, and is thus immediately under cover. (*c*) In autumn, the larva uses the hollowed needle as a case in which, attached to the stem or branches, it overwinters, (*d*) Larvae falling with the needles

in autumn probably all die. (*e*) Adults seldom move far from the place where they emerge.

The results of experiments on control, made in 1939–43 and in 1946, were as follows:— (1) *Summer sprays* (June): Nicotine (0·1 per cent.) + Aseptine (0·15 per cent.) as a spreader, and the proprietary preparation Nikopren (0·1 per cent.), were both effective and could be used for ornamental trees or nursery stock. A July spraying was unsuccessful. (2) *Summer or spring dusting*: June treatments with derris (0·75 per cent. rotenone) or pyrethrum (0·15 per cent. pyrethrins) proved ineffective. Laboratory dusting in April–May was ineffective in the case of pyrethrum, and although derris with rotenone concentrations down to 0·5 per cent. were effective under laboratory conditions, they proved useless, at the concentration named, in the field. In laboratory trials of Nioka (6·4 per cent. hexachlorocyclohexane) and Gesarol (6 per cent. DDT) in April, the former was ineffective, while the latter would presumably prove effective in 1 : 3 mixture with a suitable diluent. Further research is needed on this question. (3) In view of (*d*), tanglefoot bands are unnecessary. (4) *Winter sprays*: Both horticultural carbolineum (7½ per cent.) and 6-per-cent. 'Shell winter oil W.U.117' (the latter containing dinitro-*o*.-cresol) applied in March, were useless. Excellent results, on the other hand, were given by aqueous solutions of dinitro-*o*.-cresol preparations, viz. 0·5-per-cent. 'D.N.C. Krimpen' and 2-per-cent. 'Selinon', applied in mid-April (when flushing was imminent) and mid-March respectively. These preparations are cheaper, better, and easier to use than nicotine summer sprays, but they are unsuitable for use in forestry, as difficulties of situation and water supply render them uneconomical. In view of this, a further alternative was tried, viz.: (5) *Winter dusting* (March) under moist conditions (after rain or in foggy weather). A dust of 1 pt. 'D.N.C. Krimpen' (1941 composition, with sodium dinitro-*o*.-cresolate as the active principle) applied on 12 March, was completely effective against the overwintering larvae. A later trial, on 29 March, when the short shoots had flushed, resulted in serious burning but controlled the moth.

After unsuccessful attempts to secure controlled infestation by *C. laricella* with a view to measuring any loss of increment in the trees, dinitro-*o*.-cresol was used to give artificial defoliation. This operation was successful, but no measurements could be made owing to the author's taking up another appointment. [Cf. *For. Abstr.* 7 (No. 1418); 9 (No. 567).]

[2581]. 45.3 : 12.25 : 13.2 (497.2). STEFANOV, D. Izpolzuvane edna osobenost v života na borovata procesionka u nas pri vodene borbata protiv sŭštata. **[Use of a feature in the life of the Pine processionary moth for its control in Bulgaria.]** *Gorsko Stopanstvo* 1 (4/5), 1945 (147–9). [Bulg.]

Since autumn 1942, this moth (*Thaumatopoea pityocampa*) has increased in Bulgaria and investigations of mass-attacked areas, undertaken in 1945, disclose certain features of its life history of importance in control. Not all the caterpillars descend to the floor to hibernate; with the autumn fall in temperature some enclose themselves in nests on the trees, and by virtue of the milder Bulgarian winter, survive and emerge for a spring feed on the needles before descending to pupate. As the ground hibernators ascend processionally with the warmer weather and descend for pupation about May, the soil thereafter contains all stages from larvae to mature pupae, so that moths keep emerging throughout the summer.

Control measures should therefore include the destruction of tree nests, by cutting the infested branches, soaking the nests in insecticide or burning with torches [cf. *For. Abstr.* 9 (No. 585)]. The wintering ground caterpillars are best tackled by removing the litter to a depth of 1–8 cm., separating the caterpillars and burning them.

[2582]. 45.3 : 12.25 : 13.2. ANDERSON, R. F. **The Saratoga spittlebug.** *J. econ. Ent.* 40 (5), 1947 (695–701).

An entomological study with some recommendations for control. [Cf. *For. Abstr.* 6 (195); 7 (Nos. 965, 2069); 9 (No. 2545).]

[2583]. 45.3 : 12.25 : 13.2 : 24.31. MATHERS, W. G. **Tree injection for the control of bark beetles.** *Bi-m. Progr. Rep. For. Insect Invest. Dep. Agric. Can.* 3 (5), 1947 (2–3).

Experiments were made in Yoho National Park, British Columbia, for the control of *Dendroctonus monticolae* in Lodgepole Pine by means of chemical injection of trees. The methods of treatment were (1) collar method with sodium arsenite, copper sulphate and 2,4-D in solutions and (2) dry-packing method

using an arsenic trioxide/sodium hydroxide paste. The size of the treated trees varied from 9 to 16 in. d.b.h. Individual dosages of sodium arsenite and copper sulphates were 8–16 oz. in 3–4 qt. of water; of 2,4-D, 2–4 oz. in 3–4 qt. of water; and of the arsenic paste, 5–15 oz. The point of application was 18–24 in. above the ground. Detailed analyses made about 30 days after treatment show that:—(i) the chemicals in solution were taken up readily, with excellent distribution of the sodium arsenite and copper sulphate, but with 2,4-D in streaks; (ii) the chemicals extended below the point of application, but in lower concentrations than above; (iii) the arsenic in the paste was absorbed, but distribution was not uniform; (iv) all chemicals appeared to slow up or stop the development of the egg tunnels and larval mines, but beetle mortality varied considerably; (v) sodium arsenite was the most effective chemical, causing nearly 100-per-cent. mortality above the point of application; (vi) blue-stain, which has been considered the most important factor limiting the effectiveness of this means of control, begins to appear in the outer sapwood within 30 days.

[2584]. 45.3 : 12.25 : 13.2 (794) : 42.1. STRUBLE, G. R. **Pine blow-down causes outbreak of Western Pine beetle.** *J. For.* 46 (2), 1948 (129–30).

Between 20 per cent. and 40 per cent. of a Ponderosa Pine stand on 500 acres in California were blown down in January 1944. The sequence of events developing from this circumstance and leading to an epidemic outbreak of *Dendroctonus brevicomis* is described, and emphasis laid on the importance of recognizing the bark-beetle hazard caused by windthrow, and taking timely action to prevent it.

[2585]. 45.3 : 12.25 : 13.2 (715). WEST, A. S. **The effect of the White Pine weevil on plantations on the University of New Brunswick forest.** *For. Chron.* 23 (4), 1947 (291–6).

[2586]. 45.3 : 12.25 : 13.2 (438) : 13.15. NUNBERG, M. Osnuja gwiaździsta na ziemiach polski. [***Acantholyda nemoralis* C. G. Thoms. in Poland.**] *Rozpr. Spraw. Inst. Bad. Leśn., Kraków* (*Ser. A*) No. 46, 1946. pp. 53. [Pol.e.] P.R.

An account of the distribution in Poland of this sawfly and of its life history (with detailed descriptions of the various stages), parasites and predators (of which the most important is *Formica rufa*), epidemic increase, and control, based on observations made by the author in the forests of Niepołomice, E. of Cracow. The formation of mixed woods and the abandonment of clear felling in favour of group cutting are suggested as precautionary measures. Larvae proved resistant in the laboratory to the contact dust 'Verindal'. In the forests concerned, aerial dusting with 'Hercynia' (calcium arsenite dust—11 per cent. As_2O_5) gave satisfactory results. Two dustings were carried out, but any further steps were prevented by the war.

[2587]. 45.3 : 12.25 : 13.2 (493). DELEVOY, G. Note sur la découverte en Belgique de *Chermes* (*Gillettea*) *cooleyi* Gillette. [**Note on the discovery of the Douglas Fir Adelges in Belgium.**] *Bull. Soc. for. Belg.* 52 (9/10), 1945 (115–23). [F.]

[2588]. 45.3 : 12.26–8 : 13.2 (749). **New sawfly threatens New Jersey's Pin Oaks.** *Shade Tree* 21 (1), 1948 [(4)].

The slug-like larva of a species of *Caliroa* last summer infested *Quercus palustris* in New Jersey, feeding on the lower surface of the leaves. Many trees lost $\frac{1}{3}$–$\frac{1}{2}$ or even more of their foliage. No previous reference to this insect can be found.

[2589]. 45.3 : 12.26–8 : 13.2 (73). WESTER, H. V., and ST. GEORGE, R. A. **Life history and control of the webworm, *Homadaula albizziae*.** *J. econ. Ent.* 40 (4), 1947 (546–53).

Gleditsia triacanthos is reported as a new host for the Mimosa webworm *Homadaula albizziae*. Spray tests showed that 4 lb. of arsenate of lead plus 1 quart of summer spray oil per 100 gal. of water was very effective in controlling it. Similar control was obtained with DDT. Observations show a fairly rapid spread of the moth from Washington, D.C., where it was first discovered in 1940; its spread into the eastern states of the U.S.A. is expected.

[2590]. 45.3 : 12.26–8 : 13.2 (71). DAVIAULT, L. Le charançon du peuplier et du saule. [**The Poplar and Willow weevil [*Sternochetus lapathi*].**] *For. québec.* 12 (9), 1947 (653–5). [F.]

Cf. *For. Abstr.* 9 (Nos. 2558–9).

[2591]. 45.3 : 12.26–8 : 13.2. MAULIK, S. **Willow [*Salix viminalis*] as a host-plant of *Crioceris merdigera*.** *Nature, Lond.* 160 (4070), 1947 (609–10).

47. INJURIES OF ALL KINDS TO INDIVIDUAL TREE SPECIES

See also *For. Abstr.* 9 (No. 2293).

[2592]. 47 : 12.25. WELLNER, C. A. **Pole blight—a new disease of Western White Pine.** *Sta. Pap. Nth. Rocky Mt. For. Range Exp. Sta.* No. 8, 1947. pp. 3 + plates.

Pole blight is a disease of Western White Pine [*Pinus monticola*]; recognized for the past ten years, its cause is still unknown. It appears to affect only this species, of which it attacks pole-size trees of any vigour or crown class, death taking place in 1–10 years. In the Coeur d'Alène region 38,000 acres are damaged (up to 100 per cent. mortality) and the disease is suspected in another 24,000 acres. The most noticeable symptom is a yellowing of the foliage of groups of trees or isolated trees. Closer inspection shows a thinning out of the foliage in the upper part of the crown, a stunting of needle growth, and a reduction of leader growth, which is usually followed by an abundant flow of resin through the bark of the trunk, anywhere from base to crown. This flow comes from cankered areas ranging in length from a few inches to several feet. The cambium below the cankers is dead. At this stage, or before, yellowing of foliage begins in the upper part of the crown and usually progresses downwards. Diameter growth usually slows down.

5. MENSURATION. INCREMENT. YIELD.

52. MEASUREMENT OF TREES AND TIMBER

See also *For. Abstr.* 9 (Nos. 2619, 2623–5).

[2593]. 52 : 54. ROTHACHER, J. S. **Percentage distribution of tree volumes by logs.** *J. For.* 46 (2), 1948 (115–18).

The author develops a method, based on the International ¼-in. log rule, for determining on a theoretical basis the percentage of the total volume of a tree represented by the component logs, according to their relative position in the bole, and presents tables, generally applicable throughout the Southern U.S.A., showing the percentage of total tree volume by logs, according to position, for both Pine and hardwoods.

52.1. *Diameter*

[2594]. 52.1 : 52.3. CUNNINGHAM, F. E., FILIP, S. M., and FERREE, M. J. **Relation of tree-stump diameter to diameter breast high.** *Sta. Note Ntheast. For. Exp. Sta.* No. 1, 1947. pp. 3.

Preliminary measurements to determine the effect of site and species on the stump/d.b.h. ratio, showed that the effect of site is insignificant but that there are important differences between species. Two sets of tables were then constructed from measurements made on 1,000 trees; one table shows the stump diameter when d.b.h. is known, and the other shows d.b.h. when stump diameter is known, for 15 common species in the Anthracite Region of Pennsylvania.

52.4. *Measurement of Volume*

[2595]. 52.42 (44). SCHAEFFER, L. Une enquête sur le cubage des arbres sur pied. **[An inquiry into the measurement of volume of standing trees.]** *Bull. Soc. for. Franche-Comté* 25 (4), 1947 (159–64). [F.]

Discussion and criticism of the proposed French standard for measurement of volume of standing timber [cf. *For. Abstr.* 8 (No. 2783]. The author disagrees particularly with the measurement of girth rather than diameter breast high, merchantable length of sawlogs rather than total height, and the expression of taper only by form factor, to the exclusion of various well tested local taper tables.

[2596]. 52.43. PATRONE, G. Rapporto fra i volumi delle piante di diverso diametro. **[Relation between the volume of trees of different diameter.]** *Ital. for. mont.* 2 (4), 1947 (249–50). [It.]

The writer deduces two formulae:

$$(1)\ \frac{V_1}{V} = \frac{d+10}{d}$$

and

$$(2)\ \frac{V_1}{V} = 1{\cdot}05\,\frac{d+10}{d}$$

where V = mean volume of a tree of diameter d in a given stand, and V_1 = mean volume of a tree of diameter $d + 5$ cm. in the same stand. In both cases it is assumed that the form factor is constant. In (1) it is assumed that the mean heights of trees of diameter d and diameter $d + 5$ respectively are the same; in (2), that the height expressed as a function of diameter varies according to the ordinates of a parabolic curve. Thus, if the mean volume of a tree of any given diameter is known, the application of either of these formulae enables one to calculate rapidly and with sufficient accuracy for most practical purposes, the mean volume of trees of successive 5-cm. classes.

[2597]. 52.43 : 12.25–8 (75 : 76). MESAVAGE, C. **Board-foot volume tables for Southern lumbermen, [applicable to all Eastern hardwoods, Southern Pines and Cypresses.]** *Sth. Lumberm.* 175 (2201), 1947 (195–7).

[2598]. 52.43.2 : 01.7. STOFFELS, A. Formules voor de inhoudsberekening van liggend hout. **[Formulae for calculating the volume of felled timber.]** *Ned. Boschb.-Tijdschr.* 19 (11), 1947 (313–17). [Du.f.]

The relation between sectional area (g) and its distance (x) from the midpoint of a stem can be expressed as $g = f(x)$. Supposing this function, which is normally unknown, to be developed as a MacLaurin series of the type

$$f(x) = c_0 + c_1x + c_2x^2 + c_3x^3 + \ldots,$$

where c_0, c_1, c_2 etc. are constants, three such series are elaborated with which various volume formulae (those of Huber, Smalian, Gauss-Simony, Newton-Riecke, and one supplied by the author) give accurate results.

[2599]. 52.43.2 : 12.25. LODEWICK, J. E. **Local log rule for scaling Douglas Fir.** *Timberman* 49 (2), 1947 (46, 48).

Presents a local log rule for rough green lumber recoveries based on data for 24-ft. logs obtained in the course of a mill-production study in Oregon. The number of board feet of lumber per board foot Scribner log scale decreases in general with an increase in log size. The number of board feet per cubic foot increases with log size. The ratio, board feet of lumber per cubic foot of log volume, presents a means of evaluating the degree of utilization; the greater the ratio, the better the utilization.

[2600]. 52.43.2 (485) : 32.4 : 82. NORDSTRÖM, L. Rationellare virkesmätning. **[Rationalized timber measurement.]** *Norrlands SkogsvFörb. Tidskr.* 1944 (4), (368–79). [Sw.]

A considerable portion of the costs booked to extraction work is made up of expenses theoretically chargeable to timber measurement, e.g. hauliers spend a good deal of time, when unloading, in sorting various categories of timber into different piles ready for measurement. To reduce such costs, Nordström suggests that timber should be extracted and piled unsorted, though separate piles would continue to be made for pulpwood. Scaling procedure would need to be modified: (*a*) For calculating woodcutters' and hauliers' wages each pile would be scaled by a simplified system differentiating only between Pine and Spruce timber and not between the various timber categories in each species. Only one tally would be needed for recording the output per haulier. (*b*) Scaling for sale must distinguish between timber categories, but totals are sufficient for this purpose and procedure could be simplified by using sampling methods; thus every *n*th log in procedure (*a*) would be fully scaled and graded.

In addition to saving considerable time now spent in sorting, much less tallying would be involved and any general production data required by the management in the course of the winter, should be readily available from results of procedure (*b*).

[2601]. 52.43.3 : 01.7 : 12.25. SOULOUMIAC. Application des méthodes statistiques à l'établissement d'un tarif de cubage. **[The application of statistical methods to the construction of a volume table.]** *Rev. Eaux For.* 85 (11), 1947 (649–67). [F.]

A volume table for *Pinus pinaster* and *P. halepensis* was first constructed graphically, the curve being based on data derived from measurements of 277 trees felled in Morocco. The author then constructed a second volume

table by calculation, using the methods expounded in R. A. Fisher's *Statistical Methods for Research Workers*. It was decided that the factor of height could be eliminated, since there was so close a correlation between height and girth, and the problem was, therefore, to determine a polynomial of a certain degree which would represent (within the limits of the data) the variations of volume as a function of girth. It was decided that a polynomial of the third degree was the lowest degree admissible.

52.46. Strip Surveys

[2602]. 52.46. POPESCU-ZELETIN, I. Procedeul de inventariere cu benzi de probă. **[The method of enumeration by strip surveys.]** *Rev. Pădurilor* 62 (1/3; 4/6), 1947 (1–10; 65–75). [Rum.g.]

A detailed account of the method usually employed in Rumania of enumerating by strip surveys. Strips are usually 100 × 10 m. In mountain forest it is recommended that sample strips should follow the contours, with a maximum lateral deviation of 5°. The amounts of time and labour involved in strip surveys, sample-plot method, and total enumerations are compared.

53. SOLID CONTENTS OF STACKED MATERIALS

[2603]. 53 : 07.7. TUTTLE, C. **Area integrator for determining amount of pulpwood in piles.** *Sth. Pulp Paper J.* 11 (1), 1948 (24, 50).

Account, with diagrams and photographs, of an instrument designed by the Kenyon Instrument Co., Inc., capable of determining from field photographs the amount of wood in pulpwood piles. Making use of the fact that there is a difference in reflectance between the images of the log ends and those of the interstitial spaces, an automatic photoelectric device was designed to sum the total area of the exposed wood at the end face of a stack. The best results are taken when the lighting of the photograph comes as nearly as possible from the direction of the camera. A detailed description is given of the instrument and its operation. It could also be used for other purposes, e.g. estimating the amount of land under cultivation in a given area by scanning air photographs.

56. INCREMENT

See also *For. Abstr.* 9 (No. 2148).

[2604]. 56 : 12.25–8 (51) : 55. CHOW, C. K. **Height growth of seedlings of important timber trees in the upper Towho valley, Kansu.** *Bot. Bull. Acad. Sinica* 1 (3), 1947 (201–2).

Ring counts were made on seedlings at stem heights of 15, 30 cm., etc., up to 120 cm., in order to obtain data on rates of growth and on the corrections necessary when determining the age of felled trees at stump heights within this range. Results are tabulated. The order of rapidity of growth was as follows:—(1) *Populus cathayana*, (2) *P. davidiana*, (3) *Betula mandshurica* var. *szechuanica*, (4) *B. albo-sinensis* var. *septentrionalis*, (5) *B. albo-sinensis*, (6) *Larix potaninii*, (7) *Picea neoveitchii*, (8) *P. asperata*, (9) *Pinus tabulaeformis*, (10) *Abies faxoniana*, (11) *Ficea purpurea*, (12) *Juniperus tibetica*, and (13) *J. saltuaria*. [Cf. *For. Abstr.* 9 (Nos. 2023, 2135).]

[2605]. 56 : 12.25–8 (51) : 53.43.3 : 57. TENG, S. C. **Studies of Chinese timber trees in reference to forest management. II.** *Bot. Bull. Acad. Sinica* 1 (4), 1947 (309–21).

Growth data and volume tables for various species of *Picea*, *Abies*, *Pinus*, *Tsuga*, *Juniperus*, *Larix*, *Betula*, *Populus* and *Quercus* in different parts of western China. [Cf. *For. Abstr.* 4 (98).]

[2606]. 56 : 12.25 : 22.88.2 : 66. MOWAT, E. L. **High yields from young-growth Ponderosa Pine.** *For. Res. Notes. Pacif. Nthwest. For. Exp. Sta.* No. 37, 1947. pp. 3.

A management study which demonstrates the possibility of realizing high yields from well stocked second-growth Ponderosa Pine, and of making thinnings which provide early returns while maintaining volume and quality increment at high levels.

[2607]. 56 : 12.26–8 : (497.2). GEORGIEV, Ž. Vůrhu prirasta na topolovite, vůrbovite i důbovite nasaždenija v dunavskite ostrovi 'Belene' i 'Vardim'. **[Growth of Poplar, Willow and Oak stands on the Danubian islands of Belene and Vardim.]** *Gorsko Stopanstvo* 1 (1/2), 1945 (22–4). [Bulg.]

A short account, stressing the fast, clean growth of Poplar (*Populus nigra*), Oak (*Quercus robur*) and Willow (*Salix alba*) on these islands.

While the Poplar is the best wood producer of all, the Oak reaches a d.b.h. of 36–40 cm. (and height of 22 m.) in 40 years as compared with 16 cm. elsewhere. The Willows yield 10 cu.m. per ha. at 20 years.

[2608]. 56.01 : 12.25 : 38.62 : 11.4 : 11.62.21. PRUITT, A. A. **A study of the effects of soils, water table, and drainage on the height growth of Slash and Loblolly Pine plantations on the Hofmann Forest.** *Abstr.* of thesis in *J. For.* 45 (11), 1947 (836). [Univ. of North Carolina.]

A study of the effect of drainage on height growth of *Pinus caribaea* and *P. taeda* on poorly drained, marginal forest land along the south-east coast of the U.S.A. It was found that ditching affected the depth of the water table as far back as 1,000 ft. from the drain, at a diminishing rate, but that the effect on height growth operated only over a distance of 500–600 ft. The relation of the water table to the ground surface did not appear to affect the chemical composition of the soil significantly, but physical properties seemed to improve with drainage. There was a definite correlation between the height growth and the relative position of the water table in the soil: *Pinus taeda* tended to have a greater average height near the ditch, and *P. caribaea* at a distance from it.

[2609]. 56.02 : 11.21 (471). EKLUND, B. Ett försök att numerisk fastställa klimatets inflytande på tallens och granens radietillväxt vid de båda finska riksskogstaxeringarna. [**An attempt to determine numerically the influence of climate on the radial growth of Scots Pine and Norway Spruce, using data from the two Finnish Forest Surveys.**] *Norrlands SkogsvFörb. Tidskr.* 1944 (3), (193–226). [Sw.]

Eklund's analysis is based on measurements of increment cores taken from undisturbed Scots Pine and Norway Spruce stands during the second Finnish Forest Survey of 1936–38. Decreases in ring breadth with age of tree were smoothed out by correlation analysis, and the smoothed 'ring index values' are expressed in percentage of the values for the whole period 1887–1936, which are taken as representing growth under a 'normal' climate for the region.

For Pine in S. Finland, correlations between the variations in increment of different age groups from year to year, were very good. In the 10-year period preceding the first Forest Survey of 1922–23 the index values were above normal by about 9 per cent. in S. and 7 per cent. in N. Finland. For Spruce (for which the data were relatively inadequate) the respective values were about 3 per cent. below and 6 per cent. above normal. The 10-year period preceding the second survey was unfavourable to growth in both species over the whole of the country, values for Pine being lower than normal by about 5 per cent. in the S. and 3 per cent. in the N., while those for Spruce were about 1 per cent. subnormal in both regions.

Compared with figures for the first 10-year period, those for the second differed by −14 per cent. and −10 per cent. for Pine, and by + 1 per cent. and −8 per cent. for Spruce, in S. and N. Finland respectively. As the volume increment of Pine dropped and that of Spruce rose between the two surveys, it is inferred that in Pine the effects of climate swamped those of any silvicultural measures, while the reverse may have happened in Spruce.

[2610]. 56.02 : 11.21 (791). SCHULMAN, E. **Tree-ring hydrology in Southern California.** *Univ. Ariz. Bull.* 18 (3), 1947. pp. 36.

57. DEVELOPMENT AND STRUCTURE OF STANDS. YIELD

See also *For. Abstr.* 9 (No. 2615).

[2611]. 57 : 12.25 : 56 (77). GEVORKIANTZ, S. R. **Growth and yield of Jack Pine [*Pinus banksiana*] in the Lake States.** *Sta. Pap. Lake St. For. Exp. Sta.* No. 7, 1947. pp 11.

[2612]. 57 : 12.26–8 (493). DELEVOY, G. La hêtraie sonienne dans le domaine du hêtre. [**The Beechwoods of Soignes [in Brabant], compared with some others.**] *Bull. Soc. for. Belg.* 52 (12), 1945 (217–43). [F.]

A detailed comparison of these Beech stands with similar stands in Denmark, Germany and Switzerland, in respect of density, mean total height, mean diameter, basal area, volume, decennial production, increment (diameter, height, volume, basal area), and development

of the stand generally over a period of 120 years.

[2613]. 57 : 65.7 : 65.1. MULLOY, G. A. **Growth, yield and stand composition predictions.** *Woodl. Sect. Index Canad. Pulp Pap. Ass.* No. 950 (F–2), 1947. pp. 5.

The author expounds a system for determination of yield and regulation, by means of a series of graphs [not reproduced] showing (1) number of trees per acre, average diameter and stand-density index [cf. *For. Abstr.* 8 (No. 2406)]; (2) change in composition; and (3) change in stand density. It was found, when plotting the change in density for small groups of plots, that density changes in slope with composition. Composition is therefore divided into 4 groups: 0–25 per cent., 25–50 per cent., 51–75 per cent., and 76–100 per cent. hardwoods, and the change in density determined for each group.

6. MANAGEMENT. WORKING PLANS. SURVEYS

60. GENERAL LAND MANAGEMENT

[2614]. 60.1 (786). FRIEDRICH, C. A. **A guide for range reseeding on and near the national forests of Montana.** *Sta. Pap. Nth. Rocky Mt. For. Range Exp. Sta.* No. 7, 1947. pp. 38.

Cf. *For. Abstr.* 9 (No. 2067).

60.2. *Management of Tree Plantations under Non-forest Conditions*

[2615]. 60.2 (45) : 22.2 : 57. FEDERICO, S., and BARBIANO DI BELGIOIOSO, G. Studi sulla produzione legnosa dei terreni non boscati. (Le alberate della pianura Lombarda.) **[Studies in the production of wood under non-forest conditions. (The plantations of the Lombard plain).]** *Ital. for. mont.* 2 (6), 1947 (259–75). [It.]

Report on a study of production in plantations on 7 different sites in Lombardy. The average annual increment per ha. was found to be 2·2 cu.m., of which standards produced 0·74 and coppice growth 1·46 cu.m.; amounts of timber and firewood being 0·55 and 1·65 cu.m. or 25 and 75 per cent. respectively. Average increment has increased more than 2½ times and the proportion of timber increased from 12·5 to 25 per cent. since 1914, chiefly owing to the more extensive and intensive cultivation of Poplar. The results of the study are presented in a series of tables which give total number of trees and total volume, as well as number of trees and volume per ha. for each plantation, distinguishing between standards and coppice growth. [Cf. *For. Abstr.* 9 (No. 1346).]

60.3. *Management of Different Classes of Forest*

[2616]. 60.3 (73) : 09.4 : 43.1. **The management status of forest lands in the United States.** *Reappraisal Rep. U.S. For. Serv.* No. 3, 1946. pp. ii + 29.

The survey was designed to supply information on the character of recent timber-cutting practices and of fire-control measures, and on the extent to which the larger forest properties, both public and private, are being managed on a sustained-yield basis.

[2617]. 60.31 (46). ELORRIETA ARTAZA, O. La ordenación de montes en España. **[The managment of Spanish forests. [A historical survey and summary of present practices].]** *Montes, Madrid* 1 (5), 1945 (282–93). [Span.]

[2618]. 60.31.1 (671). GRANDCLEMEN, G. Le traitement et l'enrichissement de la forêt dense. **[The management and improvement of dense [equatorial] forest.]** *Bois For. Trop.* No. 3, 1947 (24–30). [F.]

A complete redistribution of forest licenses in the French Cameroons will ensure to each licensee an area varying from 10,000 to 250,000 ha. according to the capacity of his mill. The concession zone will be an area of about 2,300,000 ha., of which 750,000 ha. will be classified forest and will constitute the permanent forest estate, subject to rules of exploitation. These rules have been drawn up with a view to securing optimum utilization of the forest capital, sustained yield, controlled exploitation, and stand improvement. The author considers that the first of these objects should be achieved by insisting that operators should exploit some 40 named species, instead

of extracting only three or four valuable species, as has been done in the past. The redistribution of concessions was made on a basis of the possibility of the exploitable forest; the data on which this was calculated (derived from rapid but sufficiently precise inventories) were the following: volume of wood available per ha., 20 cu.m. in secondary and 35 cu.m. in primary forest; felling rotation, 50 years. Every licensee will be obliged to present each year a working plan for the following year, indicating the area of classified and of unclassified forest which he extends to exploit, the volume of timber destined for export or for conversion in a local industry, and the felling and transport methods to be used. A certain latitude will be allowed in deciding the size of the coupe, which may be $\frac{1}{10}$, $\frac{1}{12}$, $\frac{1}{16}$, $\frac{1}{25}$ or $\frac{1}{60}$ of the area of classified forest included in the concession, the volume of wood to be extracted each year from a coupe, being respectively $\frac{1}{6}$, $\frac{1}{4}$, $\frac{1}{3}$ or $\frac{1}{2}$ of the total inventoried volume. The licensee must enumerate by diameter class and merchantable bole all the trees, in a coupe, of those species whose exploitation is obligatory, of 30 cm. d.b.h. and above. In order to complete the inventory, agents of the forest service will survey the advance growth before felling begins. The following silvicultural measures will be applied in each coupe: (1) release of all useful species by forest service agency; (2) felling by the licensee of non-useful species, marked in advance by the forest officer, in order to open the canopy or release potentially useful trees; (3) leaving standing trees marked 'reserve' by the forest officer, either for seed or to protect advance growth. Release operations will be carried out at fixed intervals (3–5 years) between successive periods of exploitation.

61. SURVEYING. MAPPING

See also *For. Abstr.* 9 (No. 2002).

[2619]. 61 : 02.1 : 52. CROMER, D. A. N. **Handbook of forest surveying and assessment.** Forestry Commission of New South Wales, 44 Margaret St., Sydney. 1946. pp. 55.

[2620]. 61 (498). NICOLAU-BÂRLAD, G. V. Problema planurilor topografice. I. [**The problem of forest surveys. I.**] *An. Inst. Cerc. Exp. for., Bucuresti 1944–45*, 10, 1946 (129–237). [Rum.f.] P.R.

The author first divides topographical surveys into 3 classes according to the degree of accuracy and detail required, and describes the methods appropriate to each class. He then compares the accuracy of photogrammetric surveys and those made by the usual methods, outlines the principals of fundamental geodesy, and defines the objects of forest geodesy (for very extensive forests). He then deals with the proper scope and methods of a forest cadastral (land-registration) survey, which should comprise (1) a cadastral map of the forest area, (2) a register of land ownership by provinces or administration areas, (3) files for each separate forest or area of woodland, (4) an index with grid references or co-ordinates of longitude and latitude.

The specifically Rumanian problem is dealt with in some detail, including an account of the available maps on various scales, the existing cadastral surveys, geodetic survey, forest surveys, and a short historical account of the development of Rumanian forest surveying.

[2621]. 61.3 (431–5). KITCHINGMAN, G. D. **The 1945 census of woodlands in the British zone of Germany.** *Emp. For. Rev.* 26 (2), 1947 (224–7).

Describes the way in which the census of woodlands in the British Zone of Germany is being carried out. New forest maps are being drawn, and all compartments classified according to ownership, species and age classes. The author, who was recently directly connected with this work, makes an estimate of the total merchantable volume of Pine (643 million cu. ft.), Spruce (1,140), Oak (372) and Beech (1,340).

[2622]. 61.32 : 12.19 (548.7). CHAPMAN, V. J. **The application of aerial photography to ecology as exemplified by the natural vegetation of Ceylon.** *Indian For.* 73 (7), 1947 (287–314 + plates).

Account of a study made in 1945 in Ceylon, in order to explore the possibilities of aerial survey for ecological work. A description is first given of the different soil types and natural vegetation types of the island. Photographs were taken in May at an elevation of 6,000 ft. above ground level, giving a relatively uniform scale of 1/9,000. An F_8 lens and green filter were used. Further photographs, taken in August and September at 3,000 ft., using a green (August) or normal yellow

(September) filter with an F_6 lens, yielded a fairly uniform scale of 1/7,200. Results of interpretation of the photographs, as checked by ground studies, are given in detail. The photographs reproduced as illustrations are mostly stereo-pairs.

[2623]. 61.32 : 52.46 : 07.7. CRUIKSHANK, J. W. **The Forest Survey tests the helicopter.** *J. For.* 45 (12), 1947 (378–83).

The U.S. Forest Survey tested the use of visual observation from a helicopter, cruising at a height of 200 ft., for the purpose of classifying sample plots (marked out on air photographs) according to forest type, stand class and density class. Methods and results are described in some detail. Classification and final volume estimates, even by untrained observers, were more accurate than those normally obtained by interpreting the commonly used AAA aerial photographs, and cost very little more.

[2624]. 61.32 : 07.7. WILSON, R. C. **Photo interpretation aids for timber surveys.** *J. For.* 46 (1), 1948 (41–4).

Describes several inexpensive devices that simplify photographic interpretation, issued by the Pacific Northwest Forest and Range Experiment Station, Portland, Ore. They are small, pocket-sized sheets of transparent film base or cellulose acetate, and those so far issued include the following:—(1) units of measurement at a scale of 1 : 20,000; (2) wedge for measuring tree crowns and shadows on aerial photos; (3) ditto, with conversion in feet at scale of 1 : 20,000; (5) guide for estimating density of stocking on aerial photos. Any of the series may be ordered from the director of the station, 423 U.S. Court House, Portland 5, Oregon, stating the series number and the quantity desired.

[2625]. 61.32 : 52.43.3. SPURR, S. H. **Volume tables for use with aerial photographs.** Harvard Forest, Petersham, Mass. [? 1946]. pp. 12 + tbls.

The author outlines the need for new types of volume tables designed primarily for use with aerial photographs, and gives the preliminary conclusions from co-operative research in this field by the Harvard Forest and the Northeastern Forest Experiment Station. There are but 6 variables of trees and stands that can be recognized or measured on aerial photographs: the species or group of species, broad site classes, number of crowns, crown closure, tree height, and crown diameter. Each of these is discussed separately. In the case of fully stocked, even-aged, fast growing stands composed of a single species and growing on uniform sites, there is a close correlation between total height and volume per acre. Table I is a stand volume table constructed from sample-plot data for such a stand, based on total height. The correlation coefficient between actual volumes and volumes estimated from this table was 0·92.

Basal area is estimated on aerial photographs by measuring crown closure; therefore, since basal area varies directly as stand volume (height and tree form being held constant), we can assume that a stand having a crown closure of 50 per cent. will have 50 per cent. of the volume of a fully stocked stand of the same height. Repeated trials indicate that this is fairly close to the truth, provided that the stands are understocked from natural causes rather than as a result of selective cutting. It is emphasized that in aerial timber cruising, accurate volume estimates are obtained, not by measuring a limited sample accurately, but by greatly increased sampling intensity and perspective, and by stratifying the population.

A project for constructing aerial volume tables for White Pine in Harvard Forest has already yielded interesting preliminary results. Data were collected from 18 one-fifth-acre plots. Field measurements of total height, crown diameter, and number of trees were compared with aerial measurements of 'visible tree height', 'visible crown diameter', and 'visible number of trees'. Analysis of these data revealed that the visible number of trees was not significantly correlated with stand volume; that visible crown diameter was correlated with stand volume, but not to a high degree; but that the correlation index of stand volume with total height was 0·94. These studies confirm the belief that measurement of total height and crown closure is well suited for estimation of volume per acre of even-aged, rapid-growing stands, particularly if the dominant species are conifers. In estimating the volume of over-mature stands, and possibly in certain hardwood types, variations in crown diameter must be taken into account. Mixed and uneven-aged stands can be analysed by breaking down the stand into its major components; e.g.

Loblolly Pine, 75 ft. high, 20 ft. crown diameter, 20 per cent.; Loblolly Pine 50 ft. high, 10 ft. crown diameter, 30 per cent.; hardwoods 50 ft. high, 15 ft. crown diameter, 40 per cent.; non-stocked 10 per cent.; and assigning a separate volume per acre to each.

Notes are also given on estimation of volume of single trees.

[2626]. 61.32 : 65. MOESSNER, K. E. **Forest stand-size class keys for photo interpreters.** *J. For.* 46 (2), 1948 (107–9).

Describes a method used by the Forest Survey, Central States Forest Experiment Station, for the classification of forest areas from aerial photographs. The key is based on a series of stereo-pairs covering the range of stand-size classes likely to be recognized on photographs (in this case, *sawtimber* = 1,500 bd. ft./acre; *poles* = 30 sound trees, 5–11·9 in. d.b.h., but less than 1,500 bd. ft./acre; *seedling-sapling* = stands having 40 per cent. crown cover in seedlings and saplings, but insufficient sawtimber or poles to qualify in these classes; *understocked* = all areas having 10 per cent. or more crown cover, but not able to qualify in any of the above classes). The key consists of stereo-pairs of 25 representative areas with indications of height class, crown width, density, gross volume and stand size. The use of the key and the method of training interpreters to use it are described.

[2627]. 61.32 : 61.4. SPURR, S. H. **Preparation of maps with the multiscope and related instruments.** Harvard Forest, Petersham, Mass. [?1946]. pp. 12.

64. DESCRIPTION OF SITE. ASSESSMENT OF SITE AND STAND QUALITY

See also *For. Abstr.* 9 (Nos. 2196, 2291, 2608).

[2628]. 64 : 12.19.2. JAGER GERLINGS, J. H. Het waardeeren van de groeiplaats in den boschbouw. [**The assessment of habitat in forestry.**] *Ned. Boschb.-Tijdschr.* 19 (6), 1947 (161–73). [Du.]

A review (43 refs.) of efforts from Cajander's time onwards to evaluate habitat conditions on the basis of plant sociology.

[2629]. 64 : 12.25 (797) : 11.41.7. HOLTBY, B. E. **Soil texture as a site indicator in the Ponderosa Pine stands of southeastern Washington.** *J. For.* 45 (11), 1947 (824–5).

Forty soil samples were collected at a depth of 6 in. below the surface on each of 3 fairly level sites. Site quality was determined in the field by measuring the total height of about 30 dominant trees, determining their age by increment borings or Keen's age classification, and then referring to the curves giving site quality on a basis of age and height. The samples were tested in the laboratory and the results tabulated in the form of mean percentage of fine material in the soil of sites II, III, and IV. Statistical analysis shows that there is a significant difference between the means on all three sites studied and that the standard deviation is only about 3 per cent. It is concluded that the soil texture, 6 in. below the soil surface, is a fairly reliable indicator of site quality in this part of the Ponderosa Pine region.

[2630]. 64 : 12.25 : 23.24. **Planting site evaluation.** *Rep. Sth. For. Exp. Sta. 1946*, [1947], (15–16).

The evaluation of sites in young plantations is difficult because there are no site index curves for stands less than 15 years old; replacements make the ages of individual trees, and deficient records the ages of whole plantations, impossible to establish in many instances; and injuries at an early age distort the height/age relationships of young trees far more than those of older trees.

A new technique has been developed and tested for overcoming these difficulties in the case of Southern Pines [*P. taeda* and *echinata*] by basing site evaluation on measurements of a 'five-year intercept' instead of on total height. The five-year intercept is the portion of the main stem formed in 5 consecutive years, during the first of which the tree reached breast height. The average intercept length of a random sample of 25 trees is taken as the site index of a plot. Although young Southern Pines form several whorls of branches each year, the whorl at the beginning of a year's growth usually has the stoutest twigs, and the first internode, which is developed in the spring, is usually much longer than those formed later in the year, contrasting conspicuously with the very short internode usually formed at the end of the previous growing season. By means of these characteristics, it was found possible to identify individual years' growths and 5-year

intercepts fairly accurately even in Pines severely damaged by tip moth. Analyses of intercepts and of total heights and ages in plantations in which both were measured, showed that intercept length agreed better than total height with known factors of site. The only serious limitations of the method are that it cannot be used on species other than Pines or on trees that have not made at least 5 years' growth above breast height. The five-year intercept promises to be a useful index to the adequacy of release of young natural reproduction from overhead shade. The average five-year intercepts of scattered saplings may also be a practical means of evaluating site quality of nearly bare cut-over land.

[2631]. 64 : 56. [DAY, W. R.] **Problems of soil and land classification.** *Nature, Lond.* 160 (4072), 1947 (686–7). [Imperial Forestry Institute, Oxford.]

A summary account of papers and discussions at the first conference of the British Society of Soil Science. W. R. Day discussed criteria for judging the economic value of land for forestry. If the tree is to come to a proper height at maturity or at a given age, there is an optimum curve relating its rate of growth with age, for each species in a region. Any falling off from this curve is due to some soil factor making the site less suited for the economic exploitation of that species. An illustration is the rate of growth of forest on thin or wet land, often considered suitable for forestry because unsuitable for agriculture. In these conditions growth of many species, though initially rapid, is too slow for economic exploitation.

67. WORKING PLANS

[2632]. 67 : 60.31.2 (410). JAMES, N. D. G. **Working plans for estate woodlands.** Basil Blackwell, Oxford. 1948. pp. ix + 93. Price 6*s.* 6*d.*

Written to assist the British woodland owner, land agent or estate forester in preparing a simple working plan as a basis for proper woodland management. Three types of plan are considered, varying in their amount of detail according to the relative importance of forestry on three different types of estate. The 'Short Plan' deals only with such matter as is necessary in the preparation of the 'Plan of Operations' required under the Dedication of Woodlands Scheme. [Cf. *For. Abstr.* 9 (No. 2660).]

[2633]. 67 : 60.31.2 (481). KIERULF, F. Driftsplaner for gårdskoger. Det norske Skogselskaps driftsplanarbeide. [**Working plans for estate forests. The work of the Norwegian Forestry Society in drafting working plans.**] *Tidsskr. Skogbr.* 54 (3), 1946 (113–8). [Nor.]

A description of the Norwegian Forestry Society's methods of constructing working plans and how the work is organized.

[2634]. 67 (676). BRASNETT, N. V. **Working plans.** *Emp. For. Rev.* 26 (2), 1947 (253–60).

The term 'working plan' is defined, and planners are divided into (1) the orthodox who require detailed maps, enumerations, etc. before special staff can prepare fully detailed plans, and (2) the evolutionist who encourages territorial staffs to develop a gazette notice or a planting scheme to the stage of planning actually required at the time. The revision of a Uganda plan is reviewed as an example of evolution. The present intensity of tropical African utilization is shown to be about 4 cu. ft. an acre a year. The use of large homogeneous compartments to reduce office work in extensive forestry is noted. *Author's summary.*

7. FOREST ECONOMICS, VALUATION, AND FINANCE

74. VALUE OF THE STAND. VALUE OF THE FOREST

[2635]. 74. BEVERSLUIS, J. R. De grondwaarde in bosbedrijf bepaald zonder formule en zonder samengestelde interest. [**The value of the soil in forestry determined without formulae and without compound interest.**] *Ned. Boschb.-Tijdschr.* 19 (11), 1947 (307–12). [Du.]

An example is given of the determination of soil value as the difference between total capital value of the forest and the value of the growing stock (having a normal series of age classes), where the total capital value is taken to be the value of the net annual returns

(simple difference between gross returns and costs) capitalized at simple interest.

[2636]. 74.2 (944). CROMER, D. A. N. **An outline of the stumpage appraisal system.** Forestry Commission of New South Wales, 44 Margaret St., Sydney. 1947. pp. 24.

An explanation of the adaptation to New South Wales conditions of the method expounded in the 'Instructions for appraising stumpage on National Forests' issued by the U.S. Forest Service.

[2637]. 74.2 : 31.8 : 12.26–8 (943). MCGRATH, K. P. **Residual stumpage.** *Aust. Timb. J.* 13 (8), 1947 (517, 519, 545, 547, 548).

Ellis's approach to the question of residual stumpage [see *For. Abstr.* 9 (No. 1365)] from the point of view of the cost of hauling defective timber, and the practical value of his statistics are considered. It is suggested that his proposals would not provide the mills with logs at a cost proportionate to their value. Reference is made to an alternative proposal submitted four years ago, by which all assessment would be made in the first place on gross measure and a rebate would be deducted from each royalty account based on the amount of defective timber hauled. The determination of the limits of the defectiveness in logs would thus be relegated entirely to the field of sawmill economy. The difficulty of securing reliable averages in estimating sound timber in poor and variable stands is emphasized and a factual approach to the problem is recommended. *From author's summary.*

76. MANAGEMENT STATISTICS

See also *For. Abstr.* 9 (Nos. 2300, 2311, 2524).

[2638]. 76 (489) : 12.26–8 : 12.25 : 90 : 35. ULRICH, N. B. Dansk Skovbrugs Omsætningsbalance, Efteraaret 1946. **[A balance sheet for Danish forestry, autumn 1946.]** *Dansk Skovforen. Tidsskr.* 32 (9), 1947 (244–56). [Dan.]

Discusses estimates, prepared by the Danish Forest Service, of costs and receipts per cu.m. and per ha. for Beech and Norway Spruce grown in private forests. The figures arrived at indicate that whereas both in 1938–39 and in October 1946, Norway Spruce was showing a cash surplus of Kr. 5·25 per cu.m., Beech showed a deficit of Kr. 1.20 per cu.m. at the former date and a deficit of Kr. 7.55 per cu.m. in October, 1946. Beech grown in woods with a normal age-class distribution has thus been produced at a loss, and though prices have since been allowed to rise somewhat (to approximately the 1939 level), this loss will continue unless the law controlling prices is altered. Various means are suggested of preserving the place of Beech and other hardwoods in Danish forestry and national economy, e.g. raising the price ceiling for hardwoods, subsidies or tax reliefs to growers, etc. [Cf. *For. Abstr.* 8 (No. 1517).]

8. FOREST ADMINISTRATION

81. ORGANIZATION

[2639]. 81 (46) : 23.3 : 96.5 : 09.4. CASADO, L. J. El patrimonio forestal del estado. **[The State Forest Service.]** *Montes, Madrid* 3 (17), 1947 (424–9). [Span.]

A short summary of the history and achievements of the Spanish State Forest Service, which, since 1939, has reforested some 173,650 ha. of land. Tables, diagrams and maps give details of the number of hectares reforested by provinces from 1939 to 1946 and the extent and location of forest land owned by the state or reforested by the service under agreements with municipal governments, private owners, etc.

82. LABOUR QUESTIONS

See also *For. Abstr.* 9 (Nos. 2295–2302, 2391, 2600).

[2640]. 82 (485). WALLNER, O. Om arbetsledarens och förmannens uppgifter i det skogliga skyddsarbetet. **[The tasks of supervisors and foremen in the prevention of accidents and illness in forestry operations.]** *Svenska SkogsvFören. Tidskr.* 45 (3), 1947 (192–9). [Sw.]

[2641]. 82 (485). HAMMARSTRAND, E. Arbetskraftsfrågan och det större skogsbrukets behov av fasta arbetare. **[The manpower problem and the need of the larger forest**

enterprises for permanent workers.] *Svenska SkogsvFören. Tidskr.* 45 (5), 1947 (271–89). [Sw.]

With chief reference to the need for attracting and retaining labour by welfare measures, e.g. housing, social amenities.

[2642]. 82 : 07.2 (485). MacGregor, J. J., and Mitchell, D. **Work simplification: I. general principles; II. examples in Swedish forestry.** *J. Oxf. Univ. For. Soc.* (3rd *Ser.*) No. 2, 1947 (7–17).

The first part of this article explains the theory and practice of rationalization of agricultural work processes, and the second part illustrates its application to forestry by examples from Sweden where much research of this kind has been carried out.

9. FOREST POLICY

[2643]. 9 : 06.2. **The work of FAO: Division of Forestry and Forest Products.** *Unasylva* 1 (1), 1947 (53–5).

Cf. *For. Abstr.* 9 (No. 2036).

90. GENERAL PRINCIPLES OF FOREST POLICY

See also *For. Abstr.* 9 (Nos. 2036–7, 2638).

[2644]. 90 (410). Robinson, Lord. **British forestry.** *Forestry* 21 (1), 1947 (1–5).

A review of the history of forest policy in Great Britain during the past 20 years.

[2645]. 90 (431–5). Ryle, G. B. **Germany: Military Government, C.C.G., N.G.T.C.** *Emp. For. Rev.* 26 (2), 1947 (212–23).

The development of the North German Timber Control is traced from the beginning of the Military Government in the British Zone of Germany, and the restrictions of the geographical Military Government system as it affected the timber-producing industry are criticized. The several distinct operations of the N.G.T.C. are described, as well as 'Operation Woodpecker' or timber production by B.A.O.R. The German forest service has deteriorated sadly under the Hitler regime and during the post-war occupation period. The importance of ensuring its healthy resuscitation under wise control on a long-term policy is a serious responsibility, but one which can be of great training value both for German foresters and apprentices, and for British and Empire foresters. *From author's abstract.*

[2646]. 90 (73). **A programme for American forestry.** American Forestry Association. 1947. pp. 8. Cf. *For. Abstr.* 8 (No. 2831).

[2647]. 90 (931) : 05.3 : 09.1. **State Forest Service: annual report of the Director of Forestry for the year ended 31st March, 1947.** Govt. Printer, Wellington. 1947. pp. 60.

Incorporates an abridged statement of post-war policy, including a brief review of the first twenty-five years of organized forestry in New Zealand together with proposals for its future development.

91. SOCIAL AND ECONOMIC INFLUENCE OF THE FOREST. NATIONAL PARKS. RESERVES. FOREST INFLUENCES

See also *For. Abstr.* 9 (Nos. 2029, 2035).

91.1. *Rural Preservation. Reserves. National Parks. Plant and Animal Protection*

[2648]. 91.1 (44). À propos de la protection de la nature en France. [**Nature protection in France.**] *Rev. Eaux For.* 85 (11), 1947 (683–8). [F.]

[2649]. 91.1 (931) : 12.25 : 23.1 : 23.2. Chapman, V. J. **Waipoua Forest.** *New Zealand Herald* Jan. 9, 10, 11, 13, 14, 15, 1947. X.

A review of the controversy about the treatment of the Waipoua Forest, which is the largest relic of the Kauri [*Agathis australis*] forest. The main issue is whether the whole of Waipoua should be left untouched, or whether some use should be made of its valuable timber. The difficulties of obtaining regeneration of this species are also discussed. The conclusions reached are as follows:—(1) That the State Forest Service ought to guarantee that the strips of forest on each side of the state highway shall never be touched.

(2) That a block or blocks of forest should be set aside in perpetuity as inviolate, not even dead trees being removed from such areas. (3) The remainder of the forest should be managed, and it is generally agreed that the type of the present wild forest, with its comparatively light stocking of very large old trees, cannot and should not be reproduced in managed forest. (4) Kauri must be retained as the principal species in the managed portion. (5) Exceptionally large trees must be left untouched. (6) The Forest Service should undertake to remove only dead timber unless they are prepared to initiate research on the regeneration and management of Kauri. Dead trees should be removed in one operation and not, as at present, in two (i.e. lop and top should be removed at the same time as the main trunk). This will reduce fire hazard and also afford the forest a better opportunity to recover. (7) Until further research has been carried out, it is desirable that logging roads should be as narrow as possible.

[2650]. 91.1 : 13.2 (438) : 45.3. KOEHLER, W. Rola ptactwa w gospodarce leśnej. [**The role of birds in silviculture.**] *Ulotk. Wydaw. Inst. Bad. Leśn., Kraków* No. 21, 1947. pp. 30 + plates. [Pol.] P.R.

This pamphlet, issued by the Polish Forestry Research Institute, chiefly for forest service use, starts by emphasizing the important role of birds in keeping down pests, not excluding carnivorous kinds (other than jays, crows and magpies) that prey chiefly on vermin and not on other useful birds. Means of protecting the latter from their enemies and also of increasing their numbers, are discussed in a practical way; graphic illustrations show where and on what they feed, approved types of bird-tables, drinking pans and nesting boxes, and the appearance and overhead silhouettes of the chief carnivorous species. The need for planting fruit-bearing trees and bushes to attract useful birds is specially dealt with, the best kinds, with their time of fruiting and method of planting, being listed.

91.3. *Influence of the Forest on the Environment*

See also *For. Abstr.* 9 (Nos. 2041–2, 2056–8, 2060, 2665).

[2651]. 91.3 (548.7). HOLMES, C. H. **Forest influences with special reference to Ceylon.** *Emp. For. Rev.* 26 (2), 1947 (238–44 + plates).

[2652]. 91.3 : 11.15 : 11.14 : 11.11 : 11.22 (672). AUBRÉVILLE, A. Observations d'écologie générale. [**General ecological observations.**] *Agron. trop.* 2 (11/12), 1947 (592–613). [F.]

An account of various observations made during an expedition in French Equatorial Africa and Cameroon.

(1) *The influence of forest cover on total insolation near the forest floor.* Measurements were made on a number of sites with a Gorzinski solarigraph and a bowl-type actinometer. The data are given in some detail and the following conclusions are drawn. (i) Forest cover, even when very light, as in partially defoliated low dry forest, considerably diminishes total insolation near the soil. The ratio of insolation in the forest to that in the open was 20–32 per cent. in dry, partially defoliated forest, 15·5–18 per cent. in a wide ride cut in equatorial forest, and 7–8 per cent. in equatorial forest. (ii) The quantity of light available to forest plants in the method of line planting in primary forest, is very inadequate for the development of most of the valuable light-demanding species, and this method should be employed only in secondary forest. (iii) The protection afforded by forest cover against excessive transpiration is clearly useful during the first year or two after planting.

(2) *Vapour pressure and deficit of saturation of the air in equatorial Africa.* Graphs are given showing mean hourly variation in these factors on various sites at different times of the year. From the onset of the dry season, the reserves of water in the soil get rapidly exhausted and evaporation cannot make good the considerable losses caused by a very high deficit of saturation, drying winds, and a denuded soil. Fortunately, southerly winds, originating in cooler, damp forest regions, bring with them water vapour which considerably diminishes the aridity of the season—a fresh confirmation of the long-distance, climatic influence exercised by the equatorial forest masses.

(3) *Influence of forest cover on the temperature of the undergrowth.* A number of observations were made with two thermometers, one in the open and one in adjacent forest. The results lead to the general conclusion that the effect of the presence of forest cover is to flatten out the peak of the temperature curve in the middle of

the day and thus reduce the saturation deficit and the heating of the soil.

91.4. *The Forest in Hygiene and Recreation*

[2653]. 91.4 (676) : 13.2. GLASGOW, J. P., and DUFFY, B. J. **The extermination of *Glossina palpalis fuscipes*, Newstead, by hand catching.** *Bull. ent. Res.* 38 (3), 1947 (465–77 + plates).

Two blocks were isolated by 3- or 4-mile clearings on a small river in Kenya with a narrow strip of riverine bush and a low density of *Glossina palpalis fuscipes*. Catchers at the rate of 6 per 1,000 yds. of stream caught almost all the fly in one block in 3 months, and all in 6 months. Eight months later there was no reinfestation. Fly persisted all this time in the control block. An area from which *G. palpalis* was removed by hand catching 10 years ago was examined. It is concluded that it is possible not only to hand catch all the *G. palpalis*, but also to avoid reinfestation. Hand catching is the quickest and cheapest known method of reclaiming streams of this type from *G. palpalis*. Descriptions of the vegetation are given. The authors hold that, at any rate in this area, the riverine bush has no value for conservation of the soil from desiccation and erosion, but the hand-catching method of eradicating *G. palpalis* does make it possible to save, modify, or remove riverine bush without reference to the fly.

91.8. *The Forest as a Source of Employment and Income*

[2654]. 91.8 (411–4) : 24.4 : 24.2 : 33. GORRIE, R. M. **Shelterbelts and cottage industries in Scottish planning.** *Repr.* from *Scot. geogr. Mag.* 63 (1), 1947 (11–16).

Random observations on the need for co-operative management of shelterbelts and copses, and the possibility of setting up village industries to utilize thinnings from these and from the Forestry Commission's young plantations. [Cf. *For. Abstr.* 9 (No. 2665).]

92. FOREST LAW

See also *For. Abstr.* 9 (Nos. 2010, 2487, 2662–4).

[2655]. 92 (47). Aperçus sur le Code Forestier russe. **[Notes on the Russian Forest Code.]** *Action for. pisc.* No. 123, 1947 (1–2). [F.]

[2656]. 92 (492) : 35. BEVERSLUIS, J. R. Thans geldende wetgeving en andere algemeene overheidsmaatregelen, alsmede organisatie, in Nederland met betrekking tot het bosch en het hout. **[Legislation and other general government regulations, including organization, now in force in Holland with respect to forests and timber.]** *Ned. Boschb.-Tijdschr.* 19 (4), 1947 (97–102). [Du.]

Cf. *For. Abstr.* 9 (No. 673).

[2657]. 92 (498). FLORESCU, I. Legea apărării patrimoniului forestier. **[The law for the protection of the forest resource.]** *Rev. Pădurilor* 62 (7/9), 1947 (125–33). [Rum.f.]

Discussion of the new law, No. 204, cf. next abstract.

[2658]. 92 (498). ST. DUMITRESCU, N. Legea pentru apărarea patrimoniului forestier. **[The law for the protection of the forest resource.]** *Rev. Pădurilor* 62 (7/9), 1947 (133–40). [Rum.f.]

The new law No. 204, for the protection of Rumanian forest resources, is directed against the various factors threatening them, including irregular fellings, clear fellings, the fragmentation of holdings, fire, and wilful damage by man. Its more important provisions are:—The extension of the forest régime to all forests exceeding 0·25 ha. in area; the putting under management of all the forests in the country within the next 4 years, grouping them in economic units, irrespective of the situation of the property, on the plains, and by catchment areas in the mountains; forbidding clear felling with rare exceptions; reforestation of all areas exploited in the past and not yet regenerated; the obligatory improvement of degraded lands; the indivisibility of forest property; a right of pre-emption by the State in all sales of standing timber or forest land; organization of fire protection, with severe penalties, up to 10 years' hard labour, for infringement; obligatory surveillance of all private forests by forest guards; obligatory engagement of specialist staff—a forest engineer for all forests of 6,000 ha., and sub-engineer for those of 3,000 ha. and less.

[2659]. 92 (797). **An act relating to forestry; prescribing practices to be observed in the**

harvesting of forest products which will tend to insure future growth; providing for the enforcement thereof; and imposing penalties. State of Washington Substitute Senate Bill No. 158, 1945. pp. 3.

94. FOREST OWNERSHIP

See also *For. Abstr.* 9 (No. 2029).

[2660]. 94.3 (410). **The dedication of woodlands: principles and procedure.** *Bookl. For. Comm., Lond.* No. 2, 1948. pp. 48.

Includes a general outline of the scheme; the dedication covenants and agreements, with explanatory notes; the plan of operations, with forms, etc., and a section on forest records and accounts, with forms. [Cf. *For. Abstr.* 9 (No. 2632).]

[2661]. 94.3 (73). MURPHY, L. S. **State versus Federal competence [to regulate cutting on privately owned land].** *J. For.* 46 (1), 1948 (6–15).

95. FOREST TAXATION

[2662]. 95.1 (48) : 66 : 74. BRUUN, P. Merhugst i svensk og norsk Skattelovgivning. **[Excess fellings in Swedish and Norwegian tax legislation.]** *Dansk Skovforen. Tidsskr.* 32 (8), 1947 (184–96). [Dan.]

Danish tax law contains no special provision for the taxation of income from forest property. No legal sanction could thus be found for exempting from income tax the capital represented by war-time fellings in excess of the normal yield. An attempt was made to remedy this situation by the insertion of a clause (renewable annually) in the Finance Law, under which one-half of such income goes tax-free while the other half may be paid into a fund where it is temporarily exempt, though any withdrawals became liable to income tax. In view of the makeshift nature of this arrangement, Bruun summarizes the Swedish and Norwegian laws on forest taxation in the hope of stimulating useful discussion that should lead to improvements in Danish tax law.

In Sweden, taxable forest income consists of (*a*) receipts from sales of forest products, of felling rights or of growing stock if sold together with the land, and (*b*) the value of forest products consumed on the estate, e.g. building or fencing materials, firewood. From these gross receipts certain specified deductions are made for costs, property tax, interest on mortgages, etc. Exemption from tax in respect of excess fellings may be based on either the volume of the growing stock or its value. Account is taken of the *initial volume* or *value* at the time the property was acquired (minus any deduction(s) already made in respect of excess fellings) and the corresponding figures at the date when exemption is claimed. Two cases are distinguished: (1) Sale of land as forest property. (2) Sale of felling rights or sale by the owner of the products of an excess felling. Various options are possible for the owner in either case. (1) The whole of that portion of the sale price which represents standing forest is regarded as income, but the outgoing owner is entitled to deduct (*a*) the initial volume or the initial value of the growing stock when he acquired the property, or (*b*) 4 times the normal annual yield. (2) The owner may claim a deduction for a decrease in growing stock with alternative options as at (1*a*).

For the mensurational work involved, a detailed legal instruction exists, which must be observed if the claim for relief is to be fully validated.

The various options give different results according to circumstances, but owing to the greater intricacy and cost of methods based on value, volume is usually chosen as the basis of assessment.

In Norway, the forest is valued as a permanent source of income under good management. The national tax authority lays down detailed prescriptions for valuation in consultation with the forestry expert, and such a valuation *must* be accepted by the authorities making an assessment. Income is defined as a specified annual rental on the capital value of the forest, based on data for average annual yields from forests where the income from fellings is known.

Total annual volume increment as found by the prescribed methods is divided between timber and fuelwood, a price is set for each of these categories, and estimated gross receipts are obtained by simple multiplication. Account is taken of normal prices, species, dimensions, yields of and markets for special assortments, etc. Net income is found by deducting costs and charges (periodic ones being spread suitably). The rate of interest for capitalization—which also represents the tax-liable income—is at present fixed by the national tax authority at 4 per cent. As but few forests have been

adequately surveyed, valuation mostly rests on estimates. Where the standard rate of interest is obviously unjust, the tax authority has power to modify it. As the information used for assessment may become out-of-date, the owner, if he keeps sufficiently accurate records, may claim to be assessed according to the current status of his business. In any case, official revision is required at intervals of 10 years. A notable feature of the Norwegian system is that property tax based on a capital value and income tax based on rental value are co-determined by a single valuation.

[2663]. 95.1 (73) : 92. **State forest tax law digest of 1945.** Division of Forest Economics, U.S. Forest Service. 1945. pp. 79.

Gives in non-technical language the essential features of the forest tax laws current in the various states of the U.S.A. on Dec. 31st, 1945.

96. POLICY REGARDING PROTECTION FOREST, DEFORESTATION AND AFFORESTATION

See also *For. Abstr.* 9 (Nos. 2056–7, 2639).

[2664]. 96.1 (489) : 92 : 94.6. AAGESEN, V. Kan Fredskov eksproprieres? En betydningsfuld Højesteretsdom. **[Can protection forest be expropriated? An important decision of the Supreme Court.]** *Dansk Skovforen. Tidsskr.* 32 (8), 1947 (197–204). [Dan.]

The Supreme Court of Justice in Denmark has recently decided that although protection-forest areas can be expropriated for road works and the like, the regulations applying to them cannot be set aside without a special dispensation from the Ministry of Agriculture.

[2665]. 96.5 (411–4) : 91.3 : 24.4. GORRIE, R. M. **The wider implications of forestry in Scotland.** *Emp. For. Rev.* 26 (2), 1947 (208–11 + plates).

A plea is put forward for Scottish foresters and particularly those in government employment, to put more emphasis on the indirect benefits of afforestation in the domain of shelterbelts for livestock and high-altitude planting to secure more stable stream-flow for hydro-electric needs. *From author's summary.* [Cf. *For. Abstr.* 9 (No. 2654).]

[2666]. 96.5 (712.1) : 97.2. **Farm forestry and tree culture projects for the non-forested region of Manitoba: a report prepared for the post-war reconstruction committee of the Government of Manitoba by Advisory Committee on Woodlots and Shelterbelts.** 1945. pp. x + 150.

FORESTRY THE WORLD OVER

References: 1. *Annual Report of the Forest Department*, Northern Rhodesia. 2. *Australian Timber Journal*, Sydney. 3. *Bois et Forêts des Tropiques*, Paris. 4. *British Columbia Lumberman*, Vancouver. 5. *China Newsweek*, London. 6. *D.S.I.R. Timetable*, London. 7. *Foreign Commerce Weekly*, Washington. 8. *Journal of Forestry*, Washington. 9. *Journal of the Land Agents' Society*, London. 10. *Journal of the New York Botanical Garden*, New York. 11. *Lesnaya Promÿshlennost'*, Moscow. 12. *M.L.B. Log*, Amherst N.S. 13. *Maderil*, Buenos Aires. 14. *Przeglad Zachodni*, Posnań. 15. *Revue internationale du Bois*, Paris. 16. *Scottish Forestry Journal*, Edinburgh. 17. *Southern Lumberman*, Nashville, Tenn. 18. *Soviet News*, London. 19. *Timber of Canada*, Ottawa. 20. *Timber Trades Journal*, London. 21. *Timberman*, Portland, Ore. 22. *Times*, London. 23. *West Coast Lumberman*, Seattle, Wash. 24. *Wood Products*, Chicago. 25. *Woodland Research Index*, Montreal.

The numbers in brackets indicate the reference number and date of publication of the periodicals, etc., to which the annotations refer.

Conferences. U.N.E.S.C.O. is organizing an international conference on the Protection of Nature, to be held at Paris in the course of this summer. The Council for Scientific and Industrial Research (Australia) is organizing a conference on Plant and Animal Nutirition in relation to Soil and Climatic Factors, to take place August–September, 1948, in Australia. A United Nations Conference on the Conservation and Utilization of Natural Resources is planned to take place in the U.S.A. in May, 1949. The 4th International Congress of Soil Science will meet in Holland in the summer of 1950 (**6**; March 1948).

The forestry committee of the conference of colonial experts (English, French and Belgian), which met at Brussels 11–12th December, 1947, under the aegis of F.A.O., agreed on the necessity of securing international uniformity of nomenclature for commercial timbers and approved a preliminary list of commercial names for some 30 tropical West African species. Other lists will be issued from time to time (**3**; Autumn 1947).

The International Association of Wood Anatomists (Secretary, H. E. Dadswell, Division of Forest Products, Yarra Bank, Melbourne) has resumed its activities and hopes to hold a general meeting at Stockholm in 1950 on the occasion of the International Botanical Congress (**3**; Autumn, 1947).

Argentina. Plans are proceeding for the administration of the State-owned forests in Tierra del Fuego. There are to be 7 forest departments, each with its own nursery. A forest experiment station is being built in the Ushnaia district and a wood-distillation plant is planned. It is intended to exploit the forests rationally, and an adequate supply of timber has been guaranteed to the plywood factory at Ushnaia, which has been closed for two years (**13**; Dec. 1947).

The Argentine government has recently acquired as a National Park some 67,000 ha. in the region of Pulmari, containing important stands of *Araucaria* (**13**; Nov. 1947).

Australia. A Western Australian airline company has been investigating the possibility of using Yeelbia or Corkwood (*Erythrina vespertilio*) for making packing cases for air-freight. The tree grows in stream beds throughout the north-west. The wood is slightly heavier than Balsa and is said to be of comparable strength and sufficiently abundant to justify exploitation. Tests are also to be made of its suitability for making artificial legs (**2**; Nov. 1947).

Canada. Recognizing the serious threat to the national economy in the destruction of Canadian forests by insect pests and the shortage of trained investigators in the field, the 4 leading forest-industries association (B.C. Lumber Manufacturers' Ass., B.C. Loggers' Ass., Canadian Pulp and Paper Ass., and Canadian Lumbermen's Ass.) have combined to endow 4 entomological scholarships of $200 per annum for 4 years each, to be awarded to registered students at the Universities of New Brunswick, Toronto, Laval and British Columbia (**4**; Dec. 1947).

The production of roofing shingles from Saskatchewan Balsam Fir is now under consideration and initial experiments have been very successful. They could be produced at only half the cost of British Columbia Cedar shingles (**19**; Jan. 1948).

China. The Ministry of Agriculture and Forestry has announced its intention of planting a 'great wall of trees', 1,300 miles long and 10 miles wide, through the provinces of Jehol, Chahar, Shensi, Ningsia, Kansu, and Chinghai (**5**; 18.3.48).

Colombia. The Forestry Development Institute was established in October 1947 in order to study, organize, and carry out plans for the conservation, protection, reforestation and technical development of the nation's forests. It will prepare a map indicating the wooded areas suitable for commercial development and exploitation, the distribution of species, types of forest products, accessibility of timber and other forest products, and distances to consuming centres. The Institute is a quasi-autonomous public agency (**7**; 17.1.48).

France. A decree of 16th January makes provision for Government loans to forest proprietors or landowners proposing to plant, replant, or rehabilitate forest land. The loans, which can be obtained on a sufficient security at 0·25 per cent. per annum, will be repayable in a maximum of 50 annual instalments from the commencement of the work (**15**; Jan. 1948).

Germany. The timber-cutting programmes of the British and United States zones of Germany are being co-ordinated. Estimates for October 1947 to October 1948 for the combined zone are:—total fellings 30,000,000 cu.m.; domestic consumption 26,445,000 cu.m. (including 9,500,000 cu.m. of firewood); exports to the United Kingdom 2,000,000 cu.m.; mandatory U.S. and British military requirements 1,055,000 cu.m.; and exports to needy countries 500,000 cu.m. (**7**; 10.1.48).

Great Britain. With the object of giving additional training to forest workers, the Forestry Commission, in conjunction with the two Royal Forestry Societies, is again arranging a number of short courses, of 3 months' duration, to start in March and to be held respectively at the Dartington Hall, Raby Castle, Bowhill, and Darnaway estates. Expenses of the training, in addition to board and lodging costs and personal allowance, will be met by the Commission. Private owners of woodlands are earnestly invited to allow their employees to take part. It is felt that the need for such instruction is considerable. Candidates for the courses must normally have been employed in forestry work for 3 years, but 2 years' experience will be held sufficient for ex-Service men (**9**; Feb. 1948).

In October, 1947, the Royal Scottish Forestry Society held a first course in the principles of forestry for landowners and their factors; lectures were given on the preparation of working plans, the lay-out of woodlands, extraction roads, etc., preparation of the ground (including fencing and draining), choice of species, thinning, and measurement of timber. It is proposed to repeat the experiment (**16**; Jan. 1948).

About 30,000 cu. ft. of English Oak is being used for the panelling and woodwork of the new chamber of the House of Commons. It was thought that, owing to the exceptionally heavy drain on English woodlands during the war, it would not be possible to do the job in home-grown wood, but a unique parcel of plantation Oak about 300 years of age was discovered in Herefordshire and some in Shropshire, and this was felled and kiln dried to about 12 per cent. moisture content. The Oak has been quarter-cut; the fully figured wood is being used in the panelling, and that of less pronounced figure in the framing. Some of the Oak is over 23 ft. long, up to 28 in. wide and 6 in. thick, without a knot. In the roof, the heaviest beams will be made of Oak, with a backing of aircraft-grade Silver Spruce, the only timber used other than English Oak. The final colour of the woodwork will be a greyish hue which will be fixed by spraying with sulphate of iron. The Speaker's chair will be made of Blackbean from Australia, and the dispatch table is being made in Canada from native Oak (**20**; 7.2.48).

A Wycombe firm has designed a new streamlined ski which is claimed to be faster than any now in use and which will be tried out in the Olympic Games. It has been built on completely new lines,

of highly tempered steel, laminated Ash and plastic, and depends for its success on a new method of chemically bonding metal to wood. It has a steel frame and a wooden running surface (**20**; 7.2.48).

There are reports from many districts of Scotland of the splitting of the stems of trees during the summer. The species most affected are *Abies lowiana*, *A. nobilis*, *Pinus strobus* and *Picea sitchensis*. The cracks occur in many cases intermittently all along the length of the stem. They are internodal and are not confined to one side even on the same tree. They have been found to be as much as 2 in. deep. It is thought that they may be due to an exceptionally long, hot, dry season followed by heavy rain which caused the wood to swell rapidly (**16**; Jan. 1948.

Japan. Bunriko University reports that all trees which lived through the atomic bombing of Hiroshima showed two 'annual' rings in the following 12 months. Most Plum, Cherry, Camphor and Eucalyptus trees survived; most Pine and *Cryptomeria* were killed (**24**; Nov. 1947).

New Zealand. The State Forest Service is interesting itself in a new type of locomotive spark arrester invented by Mr. T. Wallen of Mangapehi (North Island). It is claimed that the new appliance will prevent bush fires caused by locomotives and log haulers. It is fitted inside the smoke chamber in front of a locomotive's boiler and consists of a circular drum in which embers and partially burned material are circulated until completely burned or pulverized (**2**; Nov. 1947).

N. Rhodesia. Stumps of *Pinus leiophylla* coppiced strongly, and several stems of this species removed in thinning and left at the roadside sprouted numerous epicormic shoots, which continued to grow and 4 months after felling were nearly a foot long (**1**; 1947).

Poland. Professor J. Rafalski of the Forestry Department of the University of Poznań, has suggested that instead of money reparation for damage to Polish forests, Germany should be made to plant a forest belt along the German side of the German-Polish frontier. This belt, 20 km. wide and 500 km. long, would add half a million ha. to the Polish forest area, would make the Oder a Polish river, and would serve as a powerful defence line, for it was demonstrated in the course of the last war that forests have by no means lost their strategical importance (**14**; Mar. 1947).

Spain. The commercial production of a water-soluble gum from the seeds of the Carob tree (*Ceratonia siliqua*) in Spain has been practised for some 12 or 14 years past. The annual production of Carob pods is over half a million metric tons, the average proportion of seed to whole pods being about 9 per cent. About 90 per cent. of the total production of pods is fed whole to livestock and only about 5 per cent. used for the production of gum at a factory in Valencia. Present production of gum provides an exportable surplus of 2,000 metric tons after meeting domestic needs. The factory also produces as a by-product a nutritious protein flour used for enriching food and pharmaceutical products (**7**; 13.3.48).

Sweden. A 'calculating machine' for determining the growth of forest trees was shown at a recent Forest Week Exhibition at Stockholm. It is used for counting the number of annual growth rings of the increment cores obtained during forest surveys by the Swedish Department of Forestry. By an ingenious combination of the microscope's feeding device and a calculating machine of a slightly modified type, the thickness of annual growth rings in the wood is registered simultaneously with the number of rings. It is possible to examine 500 cores an hour (**20**; 17.4.48).

U.S.A. The Institute of Public Administration is carrying out a study on the administrative problems arising in connexion with the development and enforcement of an American forestry policy, especially the division of labour between the national, state, and local governments, questions of finance and pricing, provision of professionally trained personnel, etc. (**8**; Feb. 1948).

The Crown Zellerbach Corporation is continuing its experiments in reforestation in Washington and Oregon and during the current season plans to plant by hand about 1,600 acres, to spot-sow 1,000 acres by hand and by 'gun', and sow another 2,600 acres from a helicopter. The helicopter is a Bell 47-B-3 model with a hopper on each side of the machine and small rotary agitator to keep

the seeds feeding into a horizontal tube where they are caught in a powerful air-jet and dispersed over baffles that shoot them out in a wide swathe. Inside the expulsion tube, a tuning device wired up to the pilot's ears informs him how the seeds are feeding out. Seeds striking the wires produce the sound (**21**; Feb. 1948).

The Coastal Plain branch of the Southeastern Forest Experiment Station, established in January, 1946, is to set to work on an intensive study of management of Loblolly Pine and particularly the problem of securing natural regeneration in cut-over areas in the coastal plains of Virginia and North Carolina which carry about 3,800,000 acres of Loblolly Pine forest. It is considered that, with good forestry practices, this area could provide some 20,000,000 man-days of employment annually. Under present conditions the forests furnish only about one-fourth that amount of work (**17**; Jan. 1948).

Last summer, for the first time, actual transmission of Elm phloem necrosis was accomplished with the Elm leaf hopper (*Scaphoideus luteolus*) at the Bureau of Entomology and Plant Quarantine, Columbus, Ohio. The disease was first reported in Ohio in 1918, but is believed to have caused the death of many Elms in Illinois in 1882, and in Kentucky in the '90's. It was not identified as a virus disease until 1938, when it reached epidemic proportions. It now extends from Nebraska, Kansas and Oklahama eastwards to Virginia, Kentucky and Tennessee, and southward to Jackson, Miss. So far, no infected tree is known to have survived (**10**; Mar. 1948).

The Corinth Machinery Co. of Corinth, Missisippi announces a new portable hydraulic sawmill. Through centralized hydraulic control, one man performs all the operations from the loading of logs on the head blocks to turning of the logs on the mill, thus eliminating 3–5 men needed to handle logs in other types of sawmill. Other features of the 'Hydramagic' mill are predetermined set works, which ensure accurately cut lumber. The mill can easily be moved from one site to another in two or three days (**17**; 15.1.48).

A test flight of a 700-passenger, all-wood seaplane was carried out on 2nd November 1947 in Los Angeles harbour. The plane is 219 ft. long with a wing span of 320 ft., and a fuselage 3 storeys high. It is made entirely of wood and plywood and has 8 engines (**24**; Nov. 1947).

A plant has been completed in Alabama for the manufacture of the Jackson Lumber Harvester, a portable sawmill specially designed for use in farm woodlands and tree farms. It can be set up in 30 and dismantled in 15 minutes, travels at a maximum speed of 45 m.p.h. as a trailer, is 32 ft. long and 8 ft. wide, but 6 ft. of the length folds up in transit. It has a 48- or 50-in. circular saw, can saw logs up to 30 in. diameter and 22 ft. long, and has an average capacity of 1,000 bd. ft. per hour. It weighs something over 2 tons, is of one-piece electrically welded construction, and is carried on two rubber-tyred wheels. The manufacturing company hires out the implement to farmers etc. and is planning a school for operators and their sawyers, to teach them the proper procedure for breaking down logs to get the greatest possible value and use from them (**12**; 9.1.48).

The Monsanto Chemical Co. is developing a portable chipper which is now undergoing field tests. Driven by a 15-h.p. motor, it is designed to chip limbs, bark, and broken wood in the forest (**23**; Jan. 1948).

It is reported that Dr. Alfred Russell, of the U.S. Dept. of Agriculture, has succeeded in making synthetic lignin and that the synthesis makes clear its very complex constitution. He thinks that a possible product of lignin would be tannic acid (**4**; Jan. 1948).

The Arizona Chemical Corporation is building a plant at Panama City, Florida, for the fractionation of tall oil. Considerable progress has already been made in such a process and it is claimed that the production of edible fats from tall oil is now technically feasible, though it is not yet known whether it would be economic (**4**; Mar. 1948).

U.S.S.R. In 1943 the Government made an important decision, to divide the forests of the U.S.S.R. into three groups, according to the purposes for which they are used. In the first group were placed forests for protective purposes, for health resorts, and for nature reserves. The second group consists of forests with exhausted timber reserves, and all other forests are placed in the third group. A definite method of forest management was introduced for each group. A new stage in the development of Soviet forestry was inaugurated by setting up a new Ministry of Forestry of the U.S.S.R. In the Decree of the Presidium of the Supreme Soviet of the U.S.S.R. of 4th April, 1947,

instituting this Ministry, all the forests of the U.S.S.R. were placed under its control (**18**; 12.12.47).

Dry distillation of hardwoods cannot satisfy the growing demand in the U.S.S.R. for acetic acid, and expansion of this industry would entail the misuse of valuable timber. Russian research has for many years looked to other possible sources of acetic acid and especially to the large potential source offered by the manufacture of industrial gas from wood. A recovery process has now been worked out and introduced into one of the largest Russian wood-gas plants, by which acetic acid can be produced twice as cheaply as by dry distillation of hardwoods, and high yields are also obtained from coniferous wood. The gas is simultaneously dried, and the removal of acetic acid, water, and resins not only prevents corrosion of metal pipes etc. but also reduces the consumption of wood for the manufacture of steel in Marten furnaces and increases their productive capacity (**11**; Aug. 1947).

Explosives can be used for making firebreaks of exposed mineral soil, protective ditches, blasting of water holes or basins, and making fire protective lines through a forest. In all such cases the explosive commonly used is ammonal ('ammonit'). Ammonal is a powder of light yellow colour, not sensitive to blows or friction; it should be stored in dry containers, as on exposure it tends to absorb moisture quickly; for making charges, ammonal is wrapped in paper, cloth, etc. It is exploded by a detonator. The explosion produces high temperature and an enormous gas pressure. For firebreaks it is advisable to have charges of 250 g. and to place them into the soil 40 cm. deep, with 2–2·5 m. spacing. The holes are made with augurs of Burovodstroy or Rosamov type. After placing the charges, the holes are tamped with earth. With the above spacing of the charges a row of craters, of 1–1·2 m. diameter, is obtained and they, as well as the nearby areas which get covered with earth to a depth of 4–7 cm., produce a strip of exposed mineral soil about 4 m. wide. Productivity of a crew of 15 men reached up to 5·5 kilometers of such fireline per day. This explosive method is suitable for establishment of firebreaks and barriers. For making fire barrier ditches the charge of 250 g. were placed at a depth of 40 cm., with 1 m. spacing. The resulting continuous ditches were 40 cm. deep and about 1–1·2 m. wide. Production with a 15-man crew was up to 2 km. per day. For deeper holes the charges should be increased proportionately. For blasting water basins, larger charges are used, according to formula $C = 2\,H\,3$, where C is the weight of the charge in kg., and H = depth of the hole for placing a charge, in meters (**25**; Mar. 1948.)